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Columbian Exhibition Notes—XV.

Editorial Correspondence.

A TOOL MAKER'S LATHE.

Nearly sixty machines are included in the exhibit of the Pratt & Whitney Co., many of these being of new designs brought out within the past year or two. No machine in the exhibit is without interest for those who admire well designed and well executed work, but the particular machine that will interest working machinists and tool makers most, perhaps, is their "tool maker's lathe"—a lathe which is "as fine as silk," and equipped with every feature calculated to delight the heart of the tool maker. The lathe is of 10″ swing, and is provided with a full set of hardened and ground draw-back collets fitted to the spindle in the same manner as in a watch maker's lathe, the hole through the spindle being $\frac{1}{16}$″ diameter. The cone has five steps for 1½″ belt; the lathe is back-geared, and has a weighted carriage with raise and fall rest. It will cut from 8 to 192 threads per inch, or from 4 to 96 per centimeter, and has accompanying it a set of 18 center reamers; threading tool holder, with full set of tools for cutting standard threads, and for other purposes; knurling tool holder, with three knurls; square threading tool holder, with cutters; Woodbridge lathe tool, with cutters; cutting-off tool, with set of blades; 4″ and 6″ three-jawed combination chucks, each with two sets of jaws; a $\frac{5}{16}$″ Almond drill chuck, besides other small tools, so that upon arrival in a tool room it is, as soon as belted, ready to do good work, and exercise a beneficent influence, this influence being still further heightened by the fact that provision is also made for keeping the change gears for catching chips and oil below the bed, and there are two large drawers below, and a smaller one above, where are also shelves for holding tools, wrenches, etc. The lathe is shown at Fig. 75.

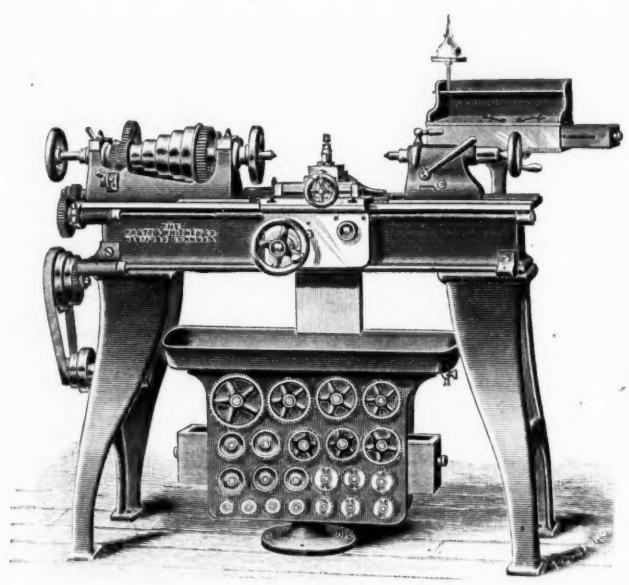


Fig. 75.—A TOOL MAKER'S LATHE.

A special feature of this lathe is in the fact that unlike other P. & W. screw-cutting lathes it has a feed rod, and this rod is driven from below by what may be called a countershaft put in for that purpose. By this arrangement the interference of gears with feed belt and *vice versa* is avoided and there is the smallest possible overhang, both gears and feed cones being as close to the lathe as it is practicable to place them.

HEAVY MILLING MACHINE.

One of the most notable milling machines shown is illustrated by Fig. 76, a similar machine being also shown here that has only one head instead of two. This machine is capable of doing such heavy work as the milling of I-section side rods of locomotives, and does it by feeding the opposite direction to what is usually considered proper for a milling machine, it being found that the cutters stand better and do more work when fed in this direction, though, of course, all lost motion must be thoroughly taken care of. The feed is by a large worm, which engages with teeth formed on the under side of the platen, the worm being divided into two parts, so that all lost motion can be taken up. The saddles carrying the spindles are independently adjustable vertically or laterally, and when in position can be securely clamped. The driving belt is 4½″ wide, and the ratio of gearing 19½ to 1.

The spindles, which are of steel, have hardened and ground thrust collars, and the front bearings are 11″ long by 5½″ diameter. The greatest distance between the spindles is 54″, and the greatest height from top of platen to center of spindles 25″. The machine is designed to use cutters 4½″ to 18″ diameter, and with a platen 6 feet long weighs 23,000 pounds.

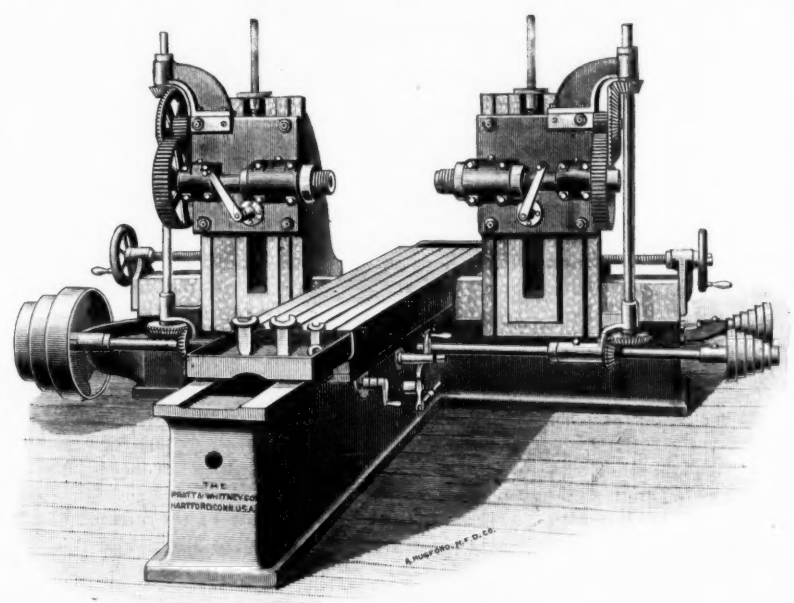


Fig. 76.—HEAVY MILLING MACHINE.

ROLL GROOVING MACHINE.

As is the case with most changes which take place in any line of machinery, the change from the burr stone to the spiral-grooved, chilled roller for grinding flour has resulted in the development of a number of new machine tools, one of which is shown in the P. & W. exhibit and is represented by Fig. 77. It is for cutting the spiral grooves in chilled rolls, and in its general design somewhat resembles a planer. Instead of the usual cross-rail, however, there are two heads or saddles, one upon each upright, both of these holding a tool, so that the cutting is done in half the time required for the single head machines.

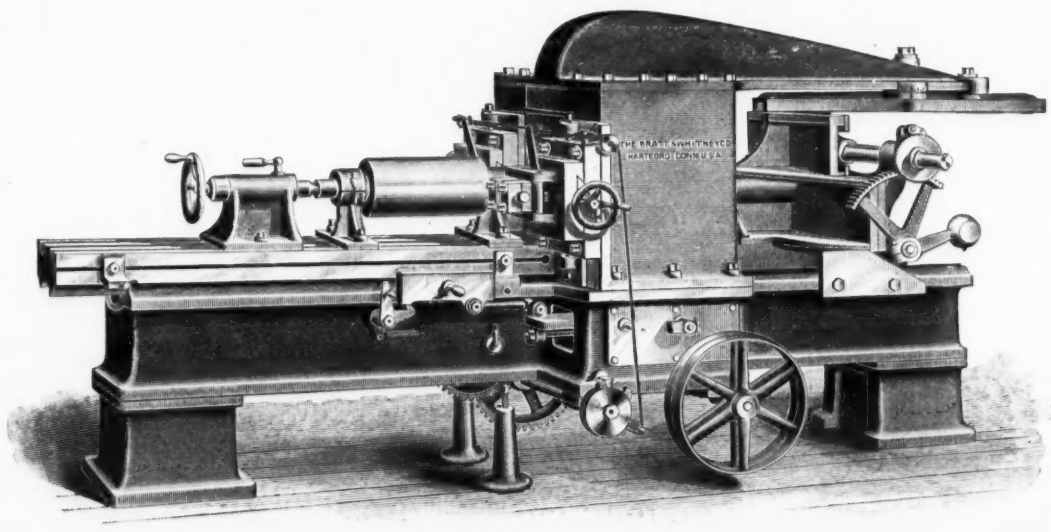


Fig. 77.—ROLL GROOVING MACHINE.

Mounted upon the platen of the machine are the special bearings for supporting the roll in the manner shown, and at the rear is an indexing spindle which imparts the necessary rotative motion to it. This it does by means of a worm gear, which is moved by a worm that is upon the cross-shaft seen at the rear of the machine and above the platen. This shaft is splined and can slide through the pinion and ratchet wheel by which it is turned, and it is thus moved endwise by the action of the adjustable guide-bar seen above, which can be set at any desired angle to give the required lateral motion to a cross-slide in which the worm-shaft is mounted. By this means as the slide moves back with the platen it is also moved laterally by this guide-bar carrying with it the worm, which is of extra length and for this purpose acts simply as a moving rack to turn the worm-wheel and give the required rotation to the roll to produce the spiral.

As the platen runs back for a new stroke an arm carrying a roller runs upon the incline seen attached to the bed, and this arm is attached to the quadrant, which in turn gives motion to a pinion and the indexing pawl, the operation of the machine being automatic after the roll is in place and tools adjusted.

Planer men who consider a return speed of platen in the ratio of 3 or 4 to 1 remarkable may be shocked to learn that this machine returns its platen at about thirteen times the cutting speed, but as the cutting speed on these chilled rolls is only 3 feet per minute the absolute rate of return is not so very reckless after all. The tools are automatically lifted or rather swung out to clear the rolls on the return stroke, and the action of the machine is exceedingly steady and smooth.

VALVE MILLING MACHINE.

Another machine which is somewhat out of the usual line of machine tools is shown at Fig. 78. (page 2). Its central idea was not derived from the Ferris wheel, as is proven by the fact that it preceded the great wheel; besides this is devoted strictly to business—not to pleasure. It is for milling the hexagons on valves, these being held on arbors which are set radially in a revolving turret, which turret by its revolution passes them between the ends of stem cutters that are placed in the six spindles seen. The turret revolves by power and the arbors are automatically indexed as it revolves. There are six of the arbors and the machine therefore finishes six valves at every revolution of the turret, the operation being continuous and at the rate of about 120 hexagons per hour.

MEASURING MACHINE.

In this exhibit is to be seen a third type of measuring machine, which in principle differs somewhat from either of those already illustrated and described in this cor-

respondence. Two machines are shown, and the construction will be understood from Figs. 79 and 80, which are respectively front and rear views of the 36″ machine. In this machine a bed with sufficient depth to give rigidity rests upon three neutral points, so that its weight is always distributed in the same manner and so as to eliminate the effects of flexure. Upon this bed are mounted two heads, the one at the left (Fig. 79) being fixed while the other is movable. Attached to this movable head is the microscope seen, which has a micrometer eye-piece, and at the back of the bed, placed upon a supporting ledge cast solid upon it, is a rectangular steel bar extending the full length of the bed, and having in its upper face small steel plugs inserted. These plugs are at intervals of one inch; their upper faces project slightly above the bar and are lapped to a very fine surface. Upon each of these lapped surfaces a very fine line is drawn by a diamond, these lines being one inch apart and forming the basis of the measurements. This standard bar when not in use is protected by a hinged metallic cover to prevent its being accidentally injured and to keep it clean.

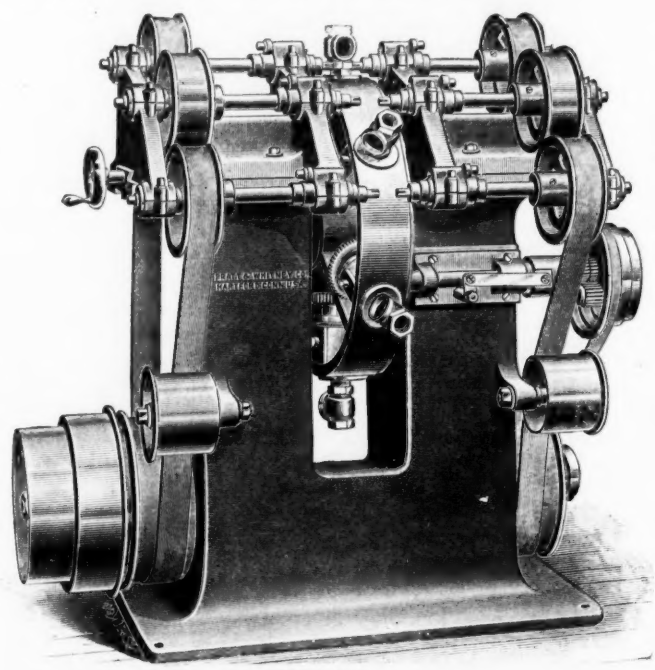


Fig. 78.

VALVE MILLING MACHINE.

The movable head is secured to the bed by a cam movement, and has a spindle corresponding to the foot-stock spindle of a lathe, which is moved by a micrometer screw at the back, the screw having fifty threads per inch and the graduated disk 400 divisions, which thus have a value of $\frac{1}{20000}$ inch The zero line can be moved by a screw to make the graduations read zero when the proper contact is secured. The spindle in the fixed head can move a small distance endwise, and can be easily pushed back against the resistance of a light helical spring, the backward movement of this spindle carrying with it one of the smaller auxiliary contact points seen under this spindle. In all measurements the reading is taken when the pressure upon the measuring contact points is just sufficient to lessen the pressure between the auxiliary contact points enough to allow the "sensitive piece" to drop from a horizontal to a vertical position, this sensitive piece being simply a small plug gauge lapped round, smooth, and of uniform diameter. This small plug when placed between the auxiliary jaws always in the same position is found to drop from a horizontal to a vertical posi

The lines on the surfaces of the plugs set into the steel bar at the back of the machine are drawn by a graduating attachment to the famous Rogers-Bond comparator, these as said above constituting the real basis of measurement which can thus always be taken for the nearest half inch, the micrometer screw, which is made as nearly perfect as possible, being depended upon for measurements within the half inch.

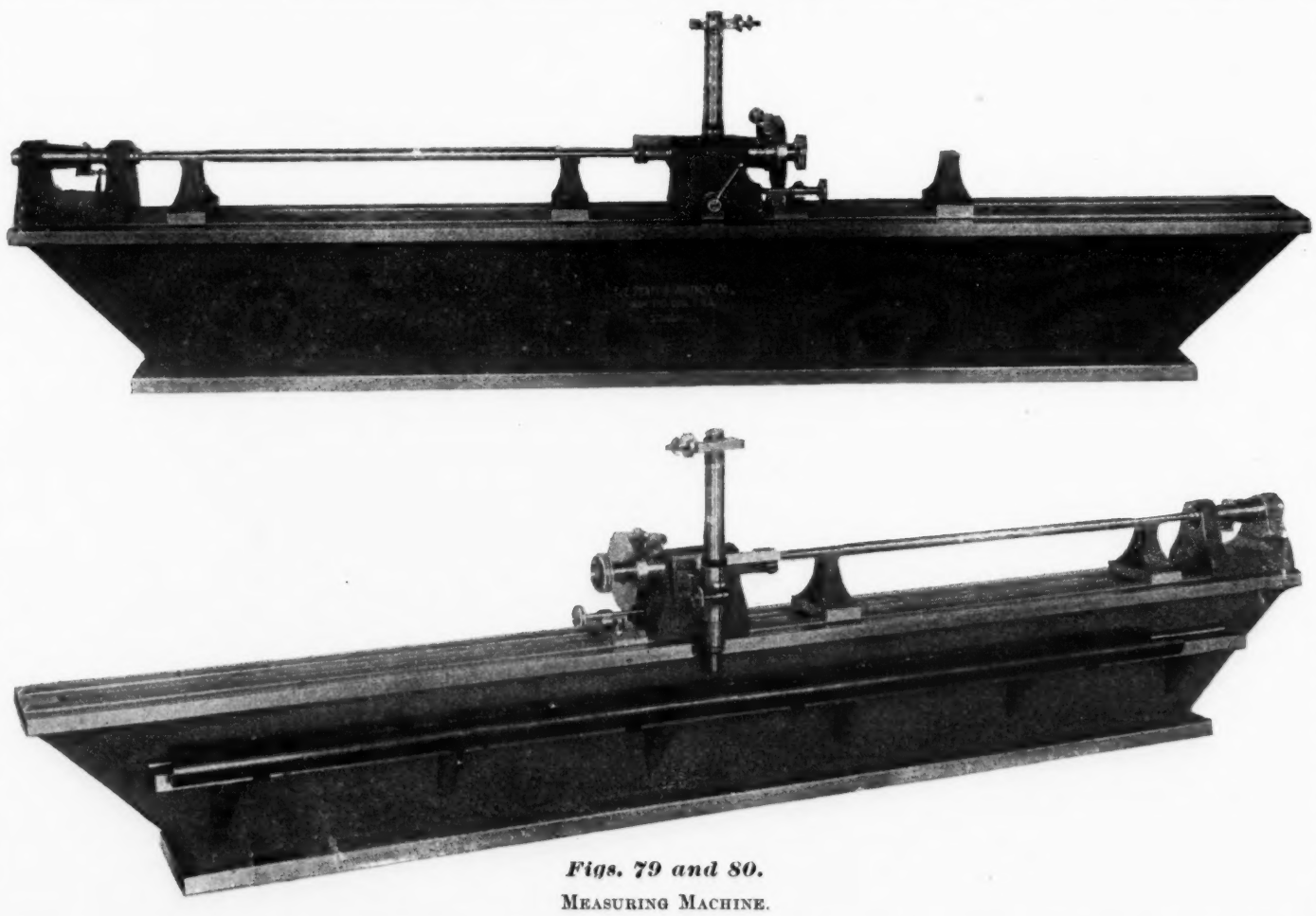
The small screw at the rear of the movable head-stock is for moving the latter slowly to center the microscope over a graduation in the bar before clamping the head.

In operation supposing the movable head to be run up close to the fixed one, and the cross-hairs of the microscope brought over the first graduation on the standard bar; if then the micrometer screw be turned until the measuring jaws come together with just sufficient force to cause the small plug or sensitive piece to drop, and the zero line is set to indicate zero, the movable head can then be slid back and the microscope brought over any other line on the standard bar. A piece then introduced between the jaws, and the latter closed upon it until the sensitive piece drops as before when the micrometer graduations read zero, will have a length exactly equal to the distance the head has been moved and for any variation from this either way, within a half inch, the micrometer graduations indicate.

Measurement can also be referred to a standard end measure piece, such as is shown in the machine in our engraving, if desired, in which case this takes the place of the graduations on the standard bar, but these end measure pieces are subject to some alteration of length by wear which the graduated bar is not.

Along with this machine are shown sets of standard end measure test pieces; plug and ring gauges; sets of the gauges adopted by the Master Mechanics' and Master Car Builders' Associations, in all of which Mr. Bond, who is in charge, naturally takes special pride, and which are a credit to any one who has had anything to do with their production.

Numerous show cases contain specimens of the small tools made by the P. & W. Co., these being as the country auction-bills say "too numerous too mention"; but the exhibit will be found a hard one to get away from by any machinist who has much interest in his business.



Figs. 79 and 80.

MEASURING MACHINE.

W. F. & JOHN BARNES CO.

The exhibit of the W. F. & John Barnes Co., of Rockford, Ill., includes a full line of their well known tools—drill-presses and lathes mainly, the former ranging in size from the smallest friction driven machine to heavy back-geared and automatic feed machines. A number of drill presses are shown in which the usual bevel gears are replaced by friction disks arranged as shown in Fig. 81, where the variation in speed is obtained by raising or lowering the small leather covered disk on the spindle, the vertical rod at the right of the spindle in connection with the clamp screw serving to hold the disk in any desired position. The amount of pressure between the disks is readily adjustable so that it need never be more than actually required for the work.

The success attained with this drill press has probably been the main incentive to the designing of a new engine lathe which is shown here and which is in some respects quite a radical departure from standard practice, especially in the method of driving.

Fig. 81.

FRICTION DRIVEN DRILL PRESS.

The usual cone pulley and back gears are discarded, and instead of these there is back of the head stock a shaft placed on a level with and at right angles to the lathe spindle. This shaft is driven at one speed by a vertical belt, which may come from overhead or from below. At the end of the shaft next the spindle there is a friction disk, the face of this disk being parallel to the spindle as the disk in the drill press is parallel to its spindle. On the lathe spindle there are two friction wheels about equal in diameter to the swing of the lathe, one of these being near the rear bearing and fixed in its position, as it is used for the backing motion only, which is thus always at the same maximum speed regardless of the cutting speed. The other wheel drives the lathe forward and is movable to give variations in speed, this being, however, always on the opposite side of the center of the disk from the wheel that does the backing, so that it drives in the opposite direction. A shifting rod conveniently placed serves to

slightly swing the bracket in which the driving shaft is placed, and thus bring the friction disk in contact with either wheel, or leave both free.

A machinist is likely to experience something of a shock when he sees this lathe—it looks so revolutionary—but it has obvious advantages, among which are the facts that the speed is more readily changed and may be *anything* between extremes instead of changing by steps, and it is quiet and very smooth working. The first impression is, however, that it will not drive strong enough, and that the side thrust imposed upon the spindle would produce objectionable lateral wear of the bearings. Upon mentioning these points to the man in charge, however, you are assured that the lathe has been thoroughly tested in the shops of its builders and found to have ample driving power and to produce no appreciable lateral wear, while its convenience and the fact that any speed desired can be obtained with it, enables a workman to do more work upon it than is possible with a similar lathe driven in the usual manner. The lathe shown is 16″ swing and the feed is arranged in much the same manner in the apron, the movement of a knurled knob in a horizontal slot in the carriage apron moving a friction wheel across the face of a disk, and thus giving any desired rate of feed with a reversal of the motion, as the center of the disk is passed. F. J. M.

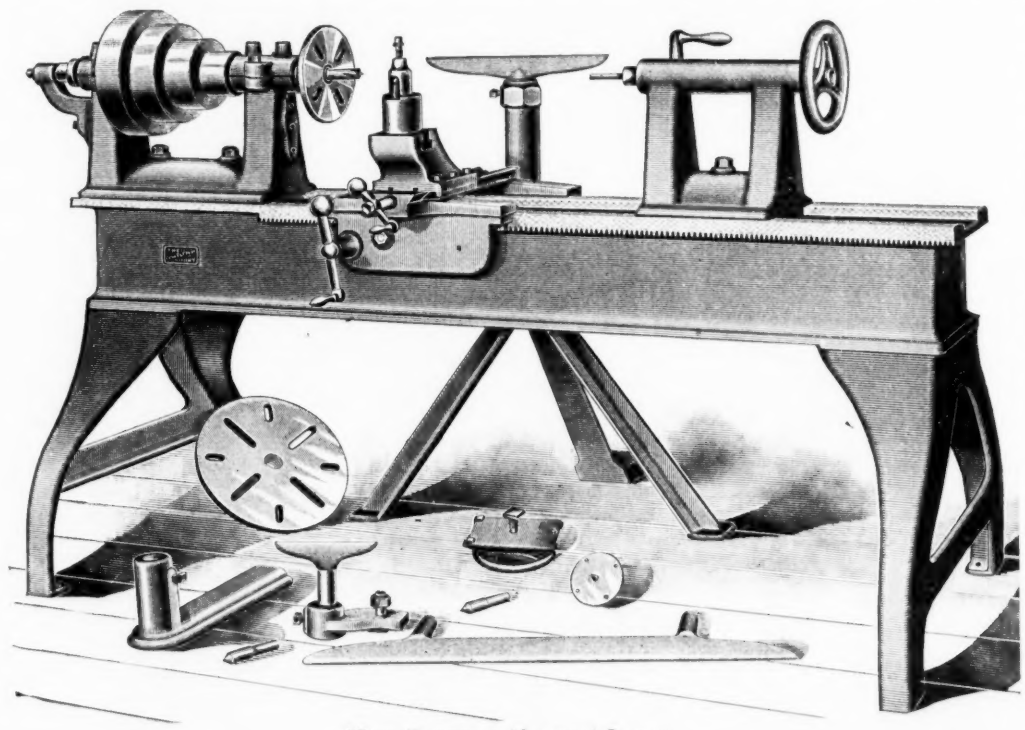
New Pattern Makers' Lathe.

The engraving on this page is of a pattern makers' lathe, made by the Frank H. Clement Co., 380 Lyell avenue, Rochester, N. Y.

The carriage has a long bearing on the bed which is fitted by scraping. The cross-feed screw has a square thread and there is a gib on the tool slide to take up wear. There is also a take-up gib at the back of the carriage on the bed. The apron gearing is cut and the pinions are steel. The tool post or poppet head is of steel with hardened set-screw and receives tools ⅝″ thick. The head and foot-stock spindles, screws, and all centers are of steel; the foot-stock screw has square threads, and the hand-wheel is turned and polished. The main bearing caps are planed into ledges on the head-stock and lined with fine babbitt, which is carefully scraped and the journals nicely fitted, so as not to heat when started. All surfaces resting on the bed are planed true and carefully fitted down. The head-stock cone is of iron, specially strengthened inside but quite light; and it can be reversed when ordered, to bring the large lift next the head center. The counter-shaft has kiln-dried cherry cone, glued up in layers with grain crossed, and finished in shellac, and it is fastened at both ends to the shaft.

The main arbor extends at both ends with reversed threads as usual, and there is a detachable yoke to take the end thrust, provided with a bronze step and a hardened steel center pin. A large face-plate for the overhanging end of the arbor, and a heavy floor rest stand are furnished. A compound rest will be furnished when ordered, in place of the rigid cross slide, as shown in the engraving.

These tools are made 16″, 20″, and 24″ swing, and the beds can be 8 feet, 10 feet, or 12 feet long.



NEW PATTERN MAKERS' LATHE.

Jet Propulsion.

The success which has attended the steam life-boat, "Duke of Northumberland" (illustrated in *The Engineer*, of September 5, 1890) seems to have stimulated not a few inventors, and we have recently received several lettters asking for information concerning jet propulsion, or claiming that the writers have solved all difficulties, and produced something much more efficient as a propeller than either the screw or the paddle wheel. It is worth while, we think, to explain why our correspondents are wrong, and so, perhaps—although we are doubtful on this point—save them from wasting money and time in pursuit of a chimera. The principles involved are very simple, yet they appear to be constantly missed in the most ingenious fashion by inventors, and it is to be feared that certain utterances of the late Mr. Froude taken without their context have proved misleading and beguiling to not a few inventors. The whole subject was dealt with in a masterly article written by Rankine, which will be found in *The Engineer* for November 2, 1866. As that article may be out of the reach of many of our readers, it is advisable once more to explain the principles affecting marine propulsion, and we shall handle the question from a point of view slightly different from that taken by Rankine, who dealt mainly with positive, instead of comparative figures.

To begin, it is necessary to explain that the propulsion of ships by steam has nothing in common, as some people suppose, with the action of a locomotive engine. The driving wheels of the latter find fixed points of resistance in endless succession on the rails. The screw and the paddle find nothing of the kind. The reaction in their case is supplied by the weight—or, to speak with strict accuracy, the inertia of the mass—of the water. In all and every case water must be driven astern in order that the ship may move ahead. This statement admits of being proved with as much certainty as any proposition in "Euclid's Elements," but we must beg to be excused from supplying the proof. Generally speaking, it is enough to say that it depends on the fact that water is extremely mobile, and that its friction is very very small. The resistance which it can offer to an oar, or a paddle, or a screw, is due practically altogether to its inertia. If, for example, a paddle-wheel float finds a ton of water at rest, and urges it astern to a velocity of 32 feet per second, the resistance will be one ton, and precisely the same in its nature as that which would be offered to the paddle-float by a ton of iron otherwise free to move. A man sitting in a boat can propel her ahead by throwing stones astern. If our correspondents once grasp this truth they will easily master what follows. Let it then be taken for granted that water must be driven astern, and note the consequences. A portion of the horse-power of the engine will be expended in moving the water, another portion will be expended in moving the ship. Obviously, the more power spent in moving the water the less will be available for moving the ship. We fear that we should defeat the object we have in view if we attempted to treat the question mathematically. Fortunately, it can be mastered by any one with a knowledge of arithmetic sufficiently to satisfy our purpose. It can be shown that the foot-pounds of work—the horse-power in a word—expended in putting a body in motion in the way that water is put in motion by the propeller varies, not as the velocity, but as the square of the velocity, which is to be measured in feet per second. Thus, if to impart a speed of 5 feet per second to successive portions of matter, so that one portion was moved every second, required 10 horse-power; then to double the velocity would require four times the power, or 40 horse power; to treble the velocity would require nine times the power, or 90 horse-power, and so on; because to double the velocity requires double the force, and the doubled force has to move at twice the speed. Thus, other things being equal, to double the thrust of a propeller, we must double the pressure on the engine piston, and double the number of revolutions. In practice, of course, other things are not equal, and the rule does not hold good, but the statement as it stands will serve to make the principle involved intelligible. It is very easy to see, therefore, that the less the speed at which water is driven astern, the less in a very rapidly augmenting ratio will be the power wasted. So far, then, two facts are clear. First, every propeller, whatever may be its nature, must move water astern; secondly, that propeller will be most efficient which sends the water astern at the least velocity.

But it is sufficiently obvious that if the quantity of water moved is small, its velocity must be high in order to get sufficient reaction, and it may very properly be urged that whenever we reduce its sternward velocity, we must increase the weight moved. This is quite true, but the deduction constantly drawn by half informed minds is not true. They think that just as much will be lost by moving two tons of water astern at 5 feet per second, as by moving one ton astern at 10 feet per second. The truth is that the reaction varies as the weight of the water moved. The rule for calculating the thrust of any propeller is: Multiply the pounds of water operated on in one second by the sternward velocity in feet per second impressed on that water by the propelling apparatus; divide the product by 32.2. The quotient will be the thrust of the propeller in pounds. That is to say, two tons of water will give twice the reaction of one ton of water. The speed remains unaltered, and the power expended in putting two tons in motion will be only twice that expended in putting one ton in motion. To repeat the illustration we have already given, the pressure on the piston must be doubled, but the number of revolutions will remain unchanged. But as we have seen, to get the same reaction out of one ton of water by doubling its velocity, will require four times instead of twice the power. We need scarcely add, that for actual practice our figures need qualification for various reasons; but it is more likely that the power expended in moving water astern will be found to increase more rapidly with the speed than we have stated. The whole theory of propulsion may be summed up in Rankine's words, "That propeller is the best, other things being equal, which drives astern the largest body of water at the lowest velocity."

Now, it is practically impossible to devise any system of hydraulic or jet propulsion which can compare favorably, under these conditions, with the screw or the paddle-wheel. Instead of a screw or a paddle, hydraulic propulsion demands either a pump of some kind, or a turbine. It would be impossible to fit within a ship a turbine or a pump sufficiently large to deal, at a very slow speed, with the enormous masses of water handled by the screw or the paddle-wheel, consequently the pump or the turbine—which is really a centrifugal pump—must impart a relatively high velocity to the water In the case of H. M. S. "Waterwitch," for example, it is said that the velocity of the water escaping at the jets was thirty knots an hour, while the ship was advancing at seven knots. No conceivable efficiency of the pump can mend matters, save in a way which will be made clear further on. A badly constructed pump will waste more engine power than a good pump; but even if its efficiency were equal to 100 per cent. of the engine power, it must still as a propeller be very inefficient, simply because it must of necessity put more work into the water than the screw or the paddle will. Putting this into Rankine's words, the slip of a jet propeller must be enormous compared with that of a screw or a paddle.

There remains to be considered another source of loss peculiar to hydraulic propulsion, and continually overlooked by inventors. The ship finds water at rest as she proceeds. The water enters the pump. It must remain in the pump for an appreciable period, but during that period it is carried forward with the ship, and acquires her velocity; and this action represents a constant resistance to the progress of the ship, and a great waste of power. To try and make our meaning clear, let us present to the mind's eye of our readers a picture of a tram car with open sides; along the track let some hundreds of men be arranged, side by side; as the car advances, let these men successively jump on the footboard, pass across the car, and jump out at the other side. It is clear that the pull on the horses will be very much increased; because they will have to go on starting men who were at rest into motion at a velocity of, say, six miles an hour. Each man as he jumps out will find that he has had momentum stored in him in crossing the car, which will tend to throw him down on his side. That has not been got for nothing. In just the same way work is done in continually putting large volumes of water into motion at the same speed as the ship. It is true, however, that the energy imparted in this way to the water is in a measure restored; because the effect is analogous to that produced when a following current in the wake of a ship impinges on the screw. The effect is to augment the forward thrust. If it were not that this effect takes place, then hydraulic propulsion would be so ineffective—not to say inefficient—that it could not be used at all.

We see, then, that everything is against the efficiency of the jet propeller. As far as principle goes, there is only one direction in which it is possible, with any faintest hope of success, to try to make it better than the screw or the paddle-wheel. The function of a propeller is, as we have said, to put water in motion astern. Curious as it may sound, it is no less true that the first duty of any

propeller is to move water, not the ship. As far as the propeller is concerned, the motion of the ship is a "by-product," so to speak. If it can be shown that a centrifugal pump, or any other pump, when fitted to a particular ship is so much more efficient as a water mover than a screw propeller fitted to the same ship would be—because the superior efficiency of the centrifugal pump will more than compensate for the smallness of the body of water sent astern by it, as compared with that sent aft by the screw—then will the jet be better than the screw, and not till then.

In conclusion, a word of warning is needed. We have repeatedly heard it stated, that by submerging the orifices of a jet propeller its efficiency is promoted. This is not the case. The work of propulsion has nothing to do with any resistance outside the nozzles. The moment a pound of water leaves the nozzle, its work is done as far as regards the ship. Complete efficiency would be got if the water escaped from the nozzle at precisely the same speed as that of the ship, so that it would fall straight down instead of rushing astern. It is worth adding, that the best conditions of working are very nearly those obtaining in a turbine or reaction water-wheel. In such wheels, when well designed and properly loaded and speeded, the water escapes with very little residual velocity. Such a condition could only exist in a ship if the volume of water was enormous. The centrifugal pump or turbine would, in a word, occupy nearly all the space in the hull. Let us imagine a tube 30 feet in diameter traversing the "Etruria" from stem to stern, and the screw propeller placed within it. We should then have a tolerably efficient jet propeller; but at what cost? After all, the turbine, or centrifugal pump, or screw propeller, or paddle is better outside in the sea than inside in the hull.—*The Engineer* (London.)

The "Gardam" Drill Presses.

We illustrate herewith some of the latest forms of drill presses as now built by Wm. Gardam & Son, 98 John street, New York.

The first of these is designed to be fastened to a bench, and is especially for fine and delicate work such as is done in electrical, jewelry and similar establishments.

As will be perceived the spindle is driven by a round belt running in two stepped, grooved pulleys, the fact that the belt can be changed from one step to another at either end without changing at the other, or can be changed at both ends, giving four speeds of the spindle. The tightening pulleys are readily adjustable and are mounted at such an angle, and in such position as to give the least possible departure from a right angled position of the belt. The spindle pulley is upon a sleeve which has upon it the bearings running in bronze bushings, the spindle sliding through this sleeve free from belt pull. The lever is connected to the top of the spindle by a ball joint and there is a helical spring at *B*, which counterbalances the spindle, returning it to its highest position when the lever is released.

Adjustments for wear are provided, and pains are taken to secure accuracy of alignment and in the construction generally.

The third figure shows the same machine mounted upon a column, this column having upon it a shelf for the reception of tools or pieces of work. The portion of this shelf which fits the column is made slightly more than a half circle, and locks itself in place when in the position shown; but by raising it up to the top of the column where the diameter of column is less, it can be removed.

The total height of this press without column is 2 feet 1 inch; greatest distance between spindle and table $9\frac{3}{8}$"; vertical movement of spindle $2\frac{1}{4}$"; of table $4\frac{1}{2}$"; distance from center of table to column 5". The machine is designed to use drills from the smallest size up to $\frac{5}{16}$".

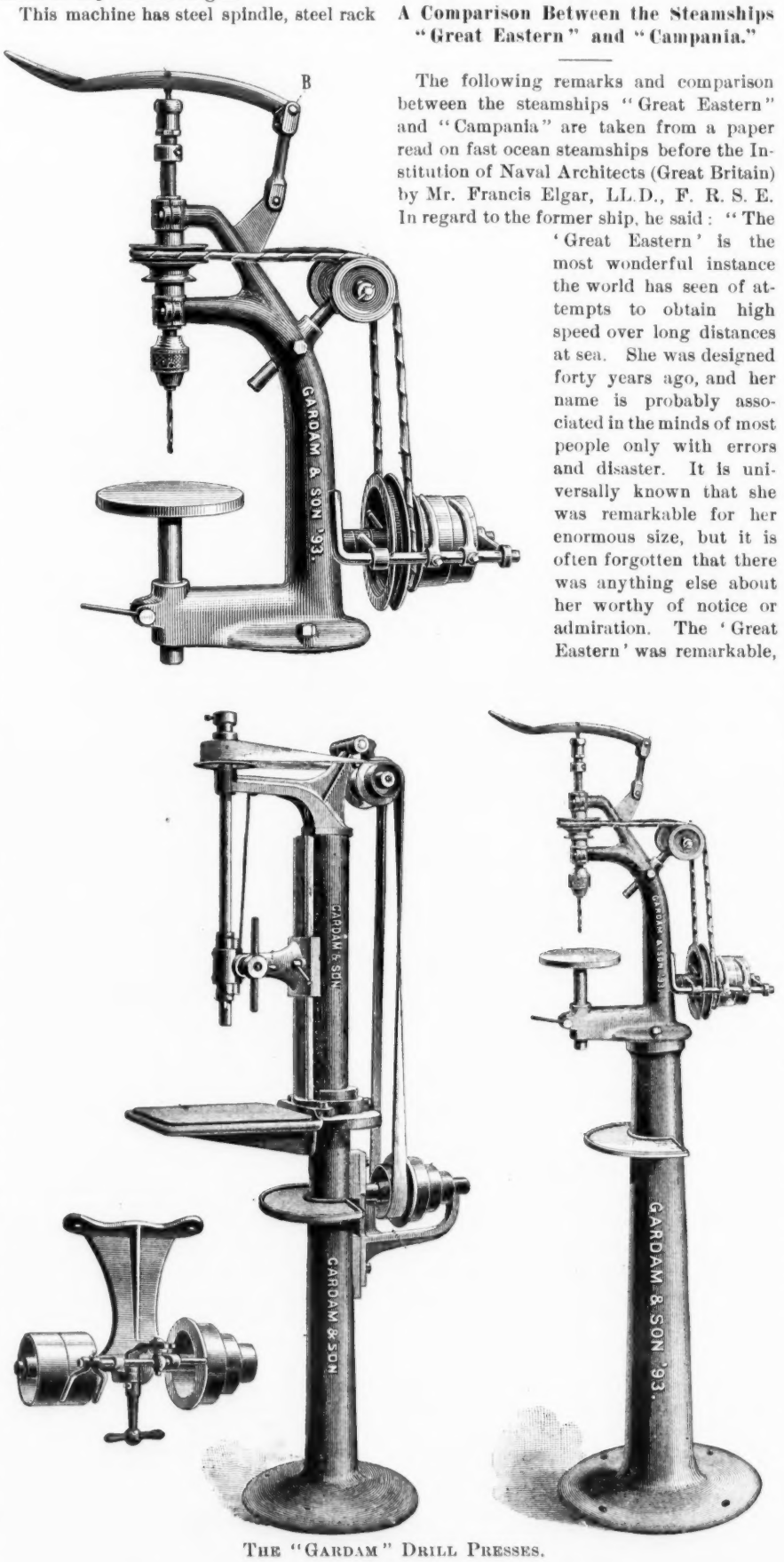
The other engraving is of a larger machine, intended for drills up to $\frac{5}{8}$" and $3\frac{1}{2}$" deep. This machine is also driven by a belt which runs on a pulley supported by a sleeve which relieves the spindle of all side strain. This belt is preferably made endless, *i. e.*, without lacing, and its tension can be regulated by the belt tightener. The bracket which supports the cone pulley at the rear of the column is adjustable vertically to govern the tension of the belts.

The countershaft, which is entirely self-contained, is shown at the left of the machine. The shipper rod can, of course, be made of any desired length.

This machine has steel spindle, steel rack and pinion, and anti friction washers to take thrust. An adjustable collar is provided at top of spindle which can be set to gauge the depth of holes and secure uniformity when desired.

Feed lever can be adjusted to give any desired length and power.

The center of the spindle is 7" from the face of the column, so that holes can be drilled to the center of a 14" circle. The greatest distance between spindle and table is 18"; spindle bored for No. 1 Morse taper. The machine as shown, including countershaft, weighs about 220 pounds.



The "Gardam" Drill Presses.

A delegation of French working men has arrived in this country, their government sending them here to inspect and study the World's Fair and our leading industrial establishments. There are among the forty or more men more machinists than those of any other one occupation. The New York *Times* allowed a smart reporter, anxious to show off his knowledge of France and the French, to ridicule these men, because they were not "Parisian Boulevardiers." But they came here for business, and seem to be attending to it.

A Comparison Between the Steamships "Great Eastern" and "Campania."

The following remarks and comparison between the steamships "Great Eastern" and "Campania" are taken from a paper read on fast ocean steamships before the Institution of Naval Architects (Great Britain) by Mr. Francis Elgar, LL.D., F. R. S. E. In regard to the former ship, he said: "The 'Great Eastern' is the most wonderful instance the world has seen of attempts to obtain high speed over long distances at sea. She was designed forty years ago, and her name is probably associated in the minds of most people only with errors and disaster. It is universally known that she was remarkable for her enormous size, but it is often forgotten that there was anything else about her worthy of notice or admiration. The 'Great Eastern' was remarkable, however, not only for the vastness of her proportions, but also for the thought, care, and skill employed in her design and construction, and for the extent to which problems relating to high speed upon the longest ocean voyages, some of which are, at times, thought to be peculiarly modern, were understood and worked out by her designer. I thought it might be interesting to compare the latest large steamship with the 'Great Eastern' more in detail than is usually done, and to bring into the comparison not merely size, but some of the leading details of design and construction.

"In the latter part of 1851, Mr. Brunel began to work out his idea of a great ship for the Indian and Australian trade. He spent two years in inquiries, investigations, and calculations relating to the numerous problems—many of them quite novel then, though more familiar now—that were raised by such a tremendous stride in advance of all former experience and ideas. The magnitude of the stride was as great as would now be involved by the construction of a ship 1,200 feet long and 30 to 35 knots speed.

"The following is a comparative statement of particulars of the 'Great Eastern' and 'Campania':

	"Great Eastern"	"Campania"
Length over all	692 ft. 0"	622 ft. 0"
Length between perpendiculars	680 " 0	600 " 0
Breadth molded	82 " 2	65 " 0
Depth molded to upper deck	58 " 0	41 " 6
Register tonnage (gross under deck)	18,915 tons.	12 950 tons.
Load draft	30 ft 0"	27 ft. 0"
Passenger accommodations (1st class.	800	600
Passenger accommodations (2d class.	2,000	300
Indicated horse power of engines, about	8,000	30 000
Speed at sea in knots at full power	14 to 14½	22 to 23

"The 'Great Eastern' had two sets of propelling machinery—one for driving a screw propeller and the other for a pair of paddle-wheels. The screw engines were the most powerful, and could indicate up to 4,500 horse-power at sea. The paddle engines indicated 3,500, so that the maximum indicated horse power was about 8,000. This power gave a speed of 14 to 14½ knots at sea, with a coal consumption of about 400 tons per day. There were four cylinders to each set of engines, those of the screw engines being 7 feet diameter, with a stroke of 4 feet; and those of the paddle engines 6 feet 2 inches diameter, with a stroke of 14 feet. The screw was four-bladed, and had a diameter of 24 feet with 44 feet pitch. The paddle-wheels were 56 feet diameter. The working steam pressure appears to have been about 20 pounds, and steam was cut off in the cylinders at one-third of the stroke. The boilers were tubular and of the square box type, and they were double ended. There were ten boilers in all, 18 feet long, 17 feet 6 inches wide, and 14 feet high, with 112 furnaces.

"The 'Campania' has also two separate sets of propelling machinery, but in her case they drive twin screws. The propelling power is fully three and a half times that of the 'Great Eastern,' and the speed more than 50 per cent. greater. This increase in power and speed is obtained with a daily coal consumption that is but little in excess of the 'Great Eastern's.' There are five cylinders to each set of the 'Campania's' engines, and they work three cranks. There are two high pressure and two low pressure cylinders, and the high pressure cylinders are placed upon the low pressure. The cylinders are 37, 79, and 98 inches in diameter respectively, with 69 inches stroke. The screw propellers are smaller than that of the 'Great Eastern.' The boilers are thirteen in number, twelve being double ended, and one single ended, with 100 furnaces—or twelve furnaces less than in the 'Great Eastern.'"

In comparing the construction of the hulls of these two steamers, the following figures are given:

"The shell plates of the 'Great Eastern,' which were ¾ inch thick, were only 10 feet long and 2 feet 9 inches wide, being, it may be presumed, the largest obtainable at that time. The weight of one of these plates would be under 7½ cwt. The bulkhead plates, which were ½ inch thick, were about 9 feet long and 3 feet wide. The progress since made in the manufacture of ship plates is shown by the fact that the shell plates of the main portion of the hull of the 'Campania,' which were ¾ inch thick, average over 26 feet in length, 5 feet 3 inches in breadth, and 45 cwt. in weight." Mr. Scott Russell says, "The 'Great Eastern' was entirely built with single riveting, the double riveting being at the butts mostly." We have since learned that much can be done to increase the strength and prevent the undue straining of such structures as a ship's hull by extra riveting. In the "Campania," three of the edges of the bilge strakes and the top edges of the upper strakes of plating on each side are treble riveted, and the re-

mainder are double riveted; and all the butts, which are lapped, as in the "Teutonic" and "Majestic," are quadruple riveted—except at the extreme ends, where they are treble riveted.

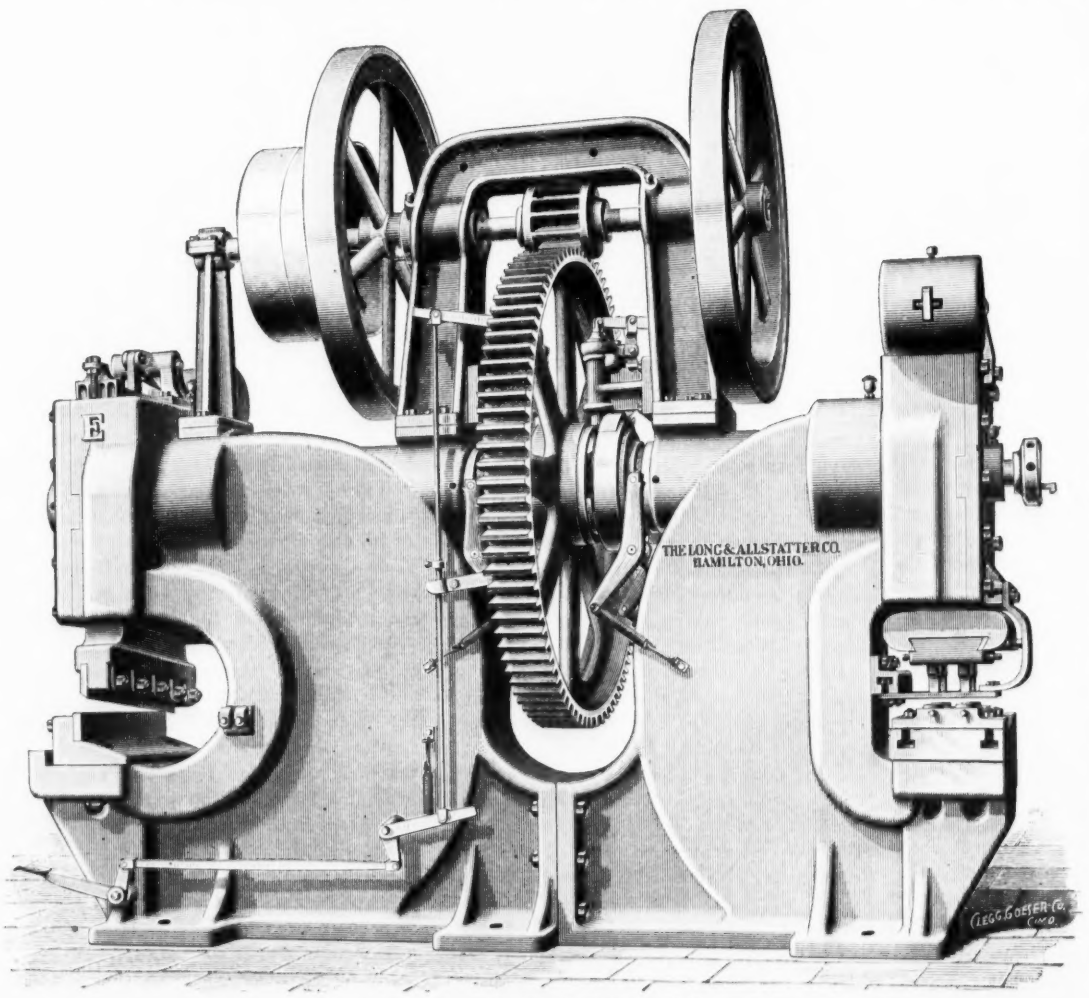
The "Great Eastern" made her first trial trip in September, 1859; and as the trade for which she was originally intended could not be worked, if at all, by a number of such ships making voyages at regular, and not too long intervals with smaller vessels in the Indian Ocean to distribute the freight and passengers among the eastern ports, this idea had to be given up. She was accordingly put into the Atlantic trade, and made nine transatlantic voyages between 1860 and 1863 Upon the fourth voyage, with 400 passengers on board, the rudder head was twisted off, and the paddle-wheels damaged in a heavy gale, and the vessel was obliged to put back to Queenstown. On another voyage outwards to New York, she passed over a reef of rocks off Long Island Sound, which tore the bottom plating open in ten places, and made one hole 80 feet long and 10 feet wide. Her very complete subdivision protected her against anything more than local damage, and most of the passengers landed in ignorance of an accident which would probably have proved fatal to any other existing vessel. The "Great Eastern's" speed upon the Atlantic sometimes reached 14½ to 15 knots average during one day, with a draught of water on leaving port of about 28 feet. Upon one voyage her speed averaged 13¾ knots outwards and 14 knots homewards. The highest average speeds upon the Atlantic in 1852, when the "Great Eastern" was designed, were about 10 knots. It will thus be seen that the anticipations with regard to her speed were not without justification.

Owing to the impossibility of working upon the Atlantic with a profit, the ship passed into other hands, and was afterwards occupied chiefly in cable-laying. After the demand for her employment in this work fell off, she lay many years, uncared for, in Milford Haven, and was at last sold and broken up.

The "Great Eastern" was a failure commercially, but from a mechanical point of view she was in all her main features successful to a degree that was marvelous, when compared with the standard of the time.

Double Punching and Shearing Machine.

The illustration on this page shows a double power punching and shearing machine, with unequal throats, the punch side being twelve and the shear side twenty-four inches deep. As illustrated, the machine is fitted with tools for special work—punching eight holes 1½"x⅞" through ⅞" steel plate, and with splitting shears for splitting 1¾" thickness, the upper blade being attached to the slide direct, and the lower blade to a block which is securely attached to the lower jaw of the machine. The tools for the gang work can be readily removed and tools attached for punching a single hole at a time. The machine has heavy steel cam shafts, which can be turned by hand from the front for adjusting and setting the tools. It is under perfect control of the operator by hand and foot levers, and is provided with an automatic stop for bringing the slide to rest at any point of the stroke. The machine is illustrated belt driven, but a steam engine can be attached, which makes the machine self-contained and independent of all belting and shafting. The machine is built by the Long & Allstatter Company, Hamilton, O.



DOUBLE PUNCHING AND SHEARING MACHINE.

On the Cultivation of the Inventive Capacity by the Solution of Constructive Problems.

BY LEICESTER ALLEN.

The solution shown in Fig. 6 in my article in the issue of August 24th, and contributed by Mr. James Tobin, has been challenged by Mr. Walter Gribben, of Brooklyn, N. Y., and also by Mr. Horace McCabe, of Lakewood, Colo., the latter sending an analysis illustrated in Figs. 1 and 2, by which it will be seen that the movement referred to has the same dead centers as the ordinary

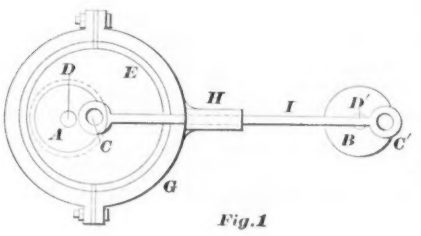


Fig. 1

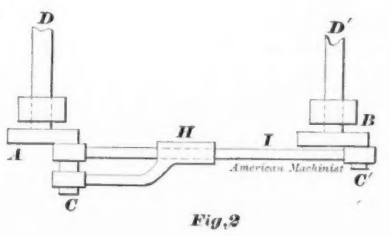


Fig. 2

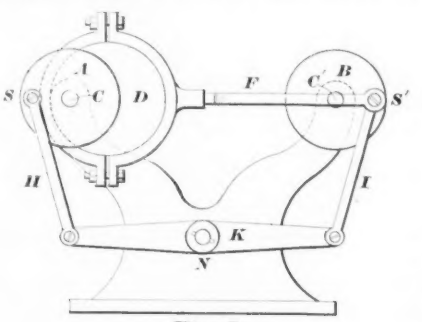


Fig. 3

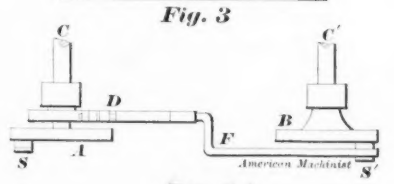


Fig. 4A

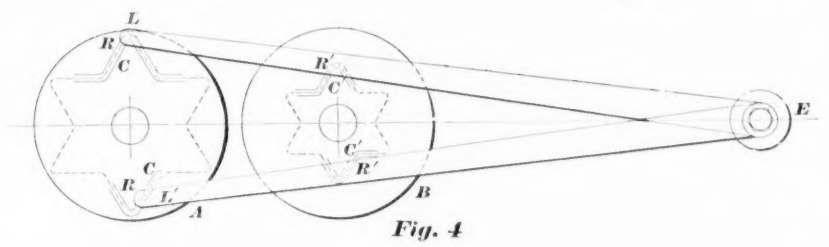


Fig. 4

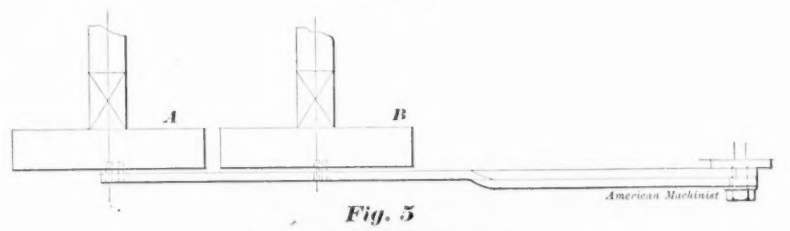


Fig. 5

CONSTRUCTIVE PROBLEMS.

connecting rod. Before noticing further Mr. McCabe's communication, I think it is fair to Mr. Tobin to say that the solution referred to was one of two sent in by him, one of which was an arrangement of slides connected with the eccentric sleeve shown at *H* in the figure alluded to, and the other was the one inadvertently given, and which Messrs. Gribben and McCabe have challenged. The arrangement with slides was operative, but by an oversight the typewritten copy for the description of the one intended to be printed was interchanged for the other. Mr. Tobin had already discovered the dead centers, and substituted his correct solution before the article was sent in to the editors of the AMERICAN MACHINIST. I had prepared the description of the first-named solution before discovering the fact that dead centers existed. And as Mr. Tobin has an office adjacent to mine in the same building, I pointed out this fact to him when I discovered it, placing the copy I already had prepared on file, and, by inadvertence, the wrong slip was put into the hands of my type-writer in the final preparation of the article. A correct solution by Mr. Tobin is shown in Fig 3 in my article published in the issue of September 14th.

However, as the device questioned has, at first sight, a very plausible appearance, so much so that I came near being deceived myself about the existence of dead centers, and as perhaps some readers have accepted it as a correct solution, I think I will give Mr. McCabe's analysis referring to Figs. 1 and 2. Mr. McCabe writes as follows:

"After having carefully read the solution of problem No. 5, contributed by Mr. James Tobin in the issue of the AMERICAN MACHINIST of August 24th, I failed to see that such a device could operate according to the requirements. I inclose two sketches to illustrate my reasons for doubting that it will work.

"Fig. 1 I copied from the sketch accompanying the solution, omitting, perhaps, a few slight details.

"*D* and *D'* are the shafts, *A* the driving wheel, *B* the driven wheel, *E* the eccentric, *G* the strap, *I* the connecting rod, and *H* the sleeve. Now an eccentric of a given throw is equivalent to a crank of the same throw, and *E* being on the center *D*, and having a throw equal to *D C*, is equivalent to a crank on *D* having a throw equal to *D C*.

'Now we have an eccentric *E*, and a crank *A* on the same center, *D*, whose lines of throw are equal and coincide. Therefore it is readily seen that *E* gives the same motion to *H* as would the crank *A* connected to it in the manner shown in Fig. 2, which would be the same as a plain connecting rod between *A* and *B*. Upon investigating the device it will be found that in whatever position the connecting rod *I* may be, the distance *C H* is constant, and that *H* has no sliding motion upon *I*, and may be fastened rigidly to *I*, and that portion of the rod between *C* and *H* may be removed, leaving a simple eccentric and rod, and give absolutely the same effect on the driven wheel *B*."

Mr. McCabe also submits a solution illustrated in Figs. 3 and 4, Fig. 3 being a side elevation, and Fig. 4 a partial plan of the device. I do not feel altogether certain that the velocity of the disk *B* as dependent upon the transmission through the links *H* and *I* will, the centers being placed as shown in Fig. 1, harmonize exactly with the motion imparted by the eccentric *D* to the disk *B*. However, I think the centers may be so placed, when the device is drawn accurately to scale, that it will operate well. Mr. McCabe's description follows:

"*A* is the driving wheel, and *B* is the driven wheel. *C* and *C'* are the shafts. Motion is transmitted from *A* to *B* through the crank-pin *S* and *S'*, the working beam *K* which swings on the stud *N*, and the links *H* and *I*, and also through the eccentric *D* placed in the rear of *A* on the same shaft *C*. This eccentric has a throw equal to and in the opposite direction from that of *A*, and being connected to the pin *S'* by the rod *F*, it serves to carry *S'* over its dead centers. The wheel *A* may be turned in either direction, and the ratio of the velocities of the two wheels is constantly as demanded."

Mr. C. E. Sargent, manager of the works of A. L. Ide & Son, Springfield, Ill., sends in the solutions shown in Figs. 4 and 5, and in Figs. 6, 7 and 8. Figs. 4 and 5 represent respectively a side elevation and plan of the first of these solutions.

"Figs. 4 and 5 represent the disks fastened to the shafts as required. *L E* represents one lever, *L' E* represents another lever, both hinged at *E*. On the faces of the disks are cut two cams, *C* and *C'*, as shown. *R* and *R'* are cam rollers which follow the cams in the two disks. As *A* revolves, the levers move to and from the center of the shaft, driving *B* at the same velocity and in the same direction. The length of the levers is such that when one lever is stopped ready to change its direction, the other lever is moving, driving *B* in the same direction as *A*. If the length of the lever *L' E* were as much longer than *L E* as it is shorter, the disk *B* would be driven in the opposite direction.

"Figs. 6, 7 and 8 represent another solution of the problem. This solution may be preferable to the first, as less room is taken up by the levers. I have not worked out very carefully the cams in either case, but see no reason why the solution does not meet the requirements of the problem."

From Mr. Geo. W. Davis, of Montreal, P. Q., comes the curious solution shown in Figs. 9 and 10. Fig. 9 is a side elevation, and Fig. 10 a plan view of this elegant and unique device. I give verbatim the description accompanying Mr. Davis' drawings:

"It will be noticed by reference to Fig. 9 that I have, for the purpose of clearness, made the head *A* in the form of a four-armed spider, instead of a disk; but it must be understood that my solution is just as applicable to a 'plain disk.' The other shaft carries the disk *B*, as provided for in the problem.

"In the face of *B* are cut four grooves *B'*, each exactly similar to the other, and pivoted to each extremity of the spider *A* are segments *a*, made in such a form as to properly fit the grooves in disk *B*. These segments are held in place by means of a helical spring (not shown) pressing them against the stop-pin *E*. Power being applied to the shaft on which *A* is attached, the motion is communicated to *B*, revolving it in the same direction through the action of the segments *a*, moving in the grooves *b*, the motion thus communicated being exactly uniform with that imparted to *A*. It will be noticed that the motion will be imparted to *A* in the manner just described if the power be applied to *B*; in other words, either shaft may be the 'driver,' and it will communicate a motion uniform with its own as regards speed and direction. It will also be observed that the shafts may be made to revolve in an opposite direction by changing the stop-pins *E*, so as to bring the segments *a* into the proper position to engage with the cam grooves.

"In order to determine that my idea was practical, I constructed a small working model, consisting of parts as shown, and fixed a piece of paper to the face of the disk *B*, and a pencil in the place of the segments, having previously connected both shafts with a belt, so that they would revolve uniformly, and in the same direction; of course the pencil correctly marked out the form of groove necessary to be made in the face of *B*, in order to impart a motion uniform with motion given to *A*."

The lower arms are omitted in Fig. 2 for the sake of clearness.

Mr. Davis writes that while he has always taken a great deal of interest in the AMERICAN MACHINIST, it has never contained anything quite so interesting to him personally as these problems.

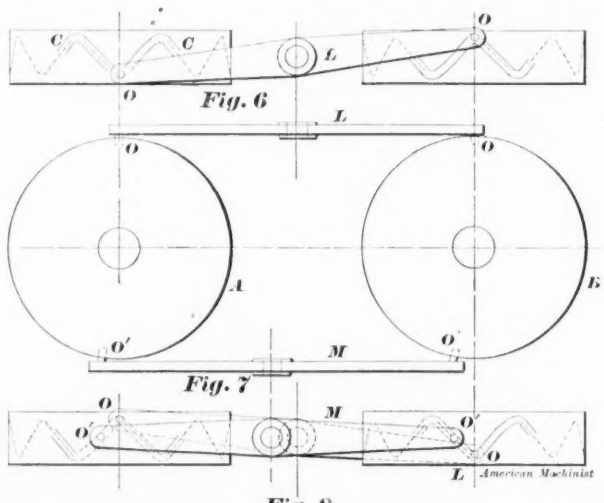
Two solutions of interest shown in Figs. 11 and 12, and in 13 and 14, have been contributed by Mr. Geo. W. Beckwith, of Cambridgeport, Mass. Figs. 11 and 12 are respectively a side elevation, and a plan view of one of these devices.

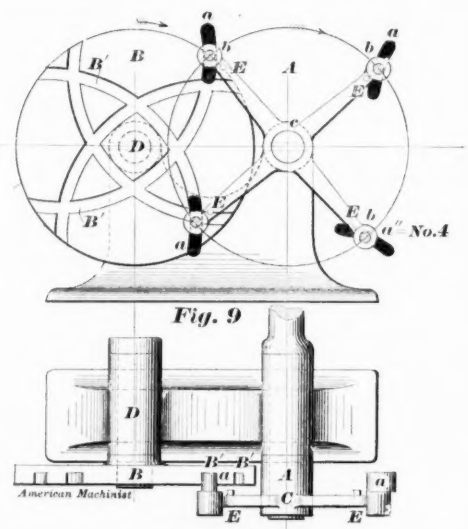
"*A A* are the disks to be rotated, either of which may be the driver, and the rotation may be in either direction. *B B* are the bearings, with arms affixed fitted at *M M* to carry the slide *C*. In the slide *C* are two vertical slots *J J*, and centrally located between them is a slot *H*, in which a block *D* is fitted to slide. *I I* are the crank-pins or studs fixed in the disks *A A*. These studs pass through slotted levers *F F* (shown in dotted lines in Fig. 11), and also through the slots *J J* in the slide *C*. Studs are fixed on the inner side of the slide *C*, at *K K*, which serve as fulcrums for the levers *F F*, which have slots *e e* to receive them. The lower ends of the levers *F F* are connected by links *G G* to the slide block *D* at *H*. The slotted levers *F F* are linked together at *H'*, where they are pivoted to the slide block *D*, and serve to carry the disks over the dead center while the slide block *D*, guided by the slot *H*, keeps the levers in proper relation of position to each other."

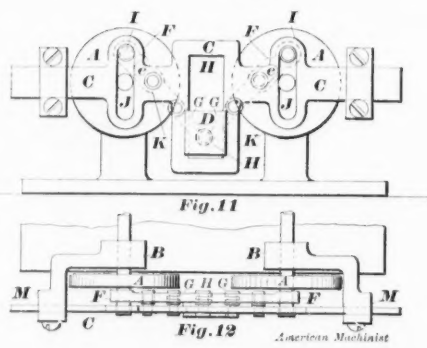
Fig. 13 is a side elevation, and Fig. 14 an end view of the second of Mr. Beckwith's solutions.

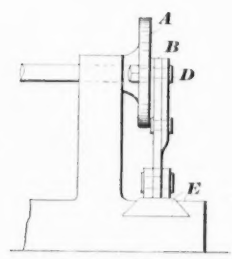
"*A A* are the disks to be rotated; *B* is the connecting rod slotted at *C*; *D D'* are the studs or crank pins; *E E* are slide blocks; *F* and *G* are levers pivoted to the blocks *E E*, and to each other at *H*. The crank-pin *D'* is fitted to the connecting rod *B* near its center. The crank-pin *D* passes through the rod *B* near the end of the latter, and it also carries the lever *F*. The lever *G* is provided with a stud on its inner side at *I*, which slides in the slot *C*. The stud *I*, and all others intended to work in slots, are supposed to have anti-friction rolls, as shown in the figures. It will be readily seen that the connecting rod *B* is always kept horizontal by the levers or links *F G*, while the slides *E E* allow the whole connecting mechanism to slide freely on a line parallel to the faces of the disks."

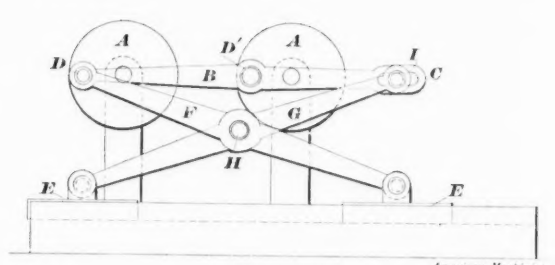
In reply to a request that I would state what this movement was originally required for in my practice, I will say that in a form somewhat modified from that shown in Figs. 4 and 5 in the issue of September 14th, I employed it to drive a train of registering mechanism in the design of a meter wherein it was not convenient to use other means for transmitting the desired movement.











CONSTRUCTIVE PROBLEMS.

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Flexible Metallic Fillet.

We present herewith an engraving showing the new form in which White's flexible metallic fillet strips are made. These strips —made of lead—are furnished in long lengths ready to be cut to fit. This has proven very popular in pattern shops, and the recent improvement gives a lighter section, costing less to produce, while more readily adapted to the pattern. When pressed to place by running a hardwood stick along the outside of the fillet, it is shellacked and bradded. It is manufactured by Howard White, 44 North Fourth street, Philadelphia, Pa.

LETTERS FROM PRACTICAL MEN.

Protection of Patents.

Editor American Machinist:

Thomas A. Edison, like Abe Lincoln and other geniuses, is credited with many things to which he has no title. Edison is too sensible a man to have made any such foolish remark as that credited to him in the AMERICAN MACHINIST of September 14th. It had its origin in the inner ignorance of some alleged journalist, who thought patents a good subject for a raking. When Edison ceases to take out patents will be when his right hand has forgotten its cunning, or there are no more fields for experiments. His own fortunes, like the fortunes of other successful inventors, are built on patents—not on inventions kept secret.

It seems a little strange that men should be so prone to decry and deride whatever is really valuable to mankind. When Prof. Joseph Henry died, I remember a communication from "our regular correspondent," in which that intelligent quill driver said such a fuss was made at his funeral because the professor was a humbug and had never done anything of any account. All the other humbugs in high places wanted to testify to their common uselessness. That is just about the gauge of intelligence which finds daily place in our newspapers for disparagement of all worldly successes. It would be curious indeed if it were true, that the world's affairs are so successfully managed by nincompoops, while the wise men stand in the background with no better occupation than throwing mud.

When an inventor has produced something of radical and revolutionary character, it would be a good thing for him if he could look ahead seventeen or eighteen years and foresee every possible modification and application of his invention. That not being possible, the next best thing is to set forth the principle of it, and claim it so broadly as to clearly apply to improvements the inventor himself or others may afterwards base upon that discovery. The claim in Bell's telephone patent may illustrate—"transmitting articulate and other sounds telegraphically." It will be easily understood that if Bell was the first to find out how to transmit articulate sounds (speech) telegraphically, that is, by means of electricity, it would be sheer robbery to cut him off without reward because somebody should presently devise a better instrument. That was a broad claim, and would cover the invention in its elements. The claim which Bell actually made had one defect, however; instead of "articulate" he said "vocal," which does not necessarily mean the same thing at all. And the machine of the patent had a defect still more serious, to wit, it would not transmit articulate sounds, while the invention which he made had the most serious defect of all—it was not intended nor expected to transmit articulate sounds. These three defects were the root of all the opposition and adverse criticism to which the Bell monopoly has been subjected, and it is very doubtful if there is in the world to-day an unbiased authority in such matters who does not believe that Bell was not an inventor of the telephone, and that the monopoly of his patent was a monstrous fraud, built and sustained by unsurpassed legal ability and unstinted expenditure of money.

However, this is a little off my subject, and perhaps only goes to show that some things may be done as well as others.

It is a favorite thought with many that the government ought to stand behind the patent, defend it, and make the patentee rich, *nolens volens*.

The same men who think that way in regard to patents for inventions, would see no propriety in a similar course as to patents for another kind of property. If the government ought to do everything for an inventor, why ought it not, when it gives a piece of land to a man who has shed his blood for the country, also stand behind and see that the ground is plowed and planted and successfully harvested, and the crop sold to good advantage?

Uncle Sam has a large business on hand without undertaking to guarantee the value of his gifts.

If patentees never had inflated ideas as to the importance of their inventions, and never claimed for their patents one whit more than the text warrants, the courts would have much easier work than they do with patent causes. It is well known, however, to most men that a patentee generally classes all competitors as infringers, and the same observation has not escaped the judges of our courts. We are, therefore, ready to concede that it does not follow, because a patentee brings a suit that the defendant *is* an infringer. The courts are, therefore, slow on the first asking to stop a defendant and ruin his business to please a man who after all may have no case.

After the patent has been once through the court, and its meaning judicially determined, there is seldom then any trouble about the injunction on the second and succeeding infringers.

S.

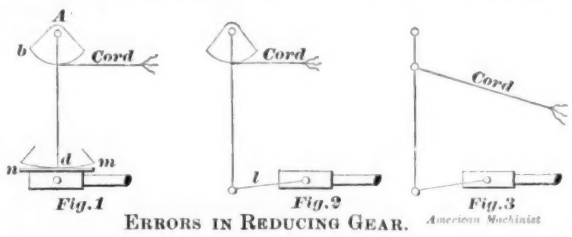
Errors in Indicator Reducing Gear.

Editor American Machinist:

I trust M. E. does not understand me as deprecating the pointing out of the errors in the gear in question. The necessity of exaggerating the defect by a choice of impossible dimensions in the drawing is obvious, but the fact should be stated very clearly, and the actual error given, if the gear one is criticising is really a useful one in practice. It may be added that even if used for a slow running engine, my remarks would still apply as to diagram length, for with even a slow running engine the diagram would not exceed 3 to 4 inches in length, and the base of the triangle or cam would be increased with the stroke of the engine, so keeping down the size of the angle of oscillation of the lever. In by far the majority of cases the indicator is employed as a means of showing up the valve setting and this triangular cam is so very much better than many other devices which involve longer cords that it is really a more trustworthy device. At the same time, if an absolutely true gear is wanted, I think the annexed sketch will fill the bill. A lever pivoted at *A* carries two Brumbo pulleys at *b* and *d*. The cord to the indicator is attached to that at *b*, and that at *d* is connected by a pair of thin steel bands to two points *n* and *m* attached to the engine crosshead at a tangent horizontal level with the arc of the Brumbo pulley *d*. I have always looked on the arrangement of Fig. 2, however, with a link *l* to connect the crosshead with the pendulum as sufficiently accurate in practice.

But in all cases it is the cord connection which causes the bulk of the trouble, and this very largely owing to the indicator barrel spring of which I would say that the helical spring, as found in an American indicator (the Crosby) always seems to me best. I have tried wires for the cords and have not found them satisfactory in general work, and have generally fallen back on "heald" cord, which our textile readers will recognize as used for looms, a specially hard woven cord which should be of linen and sized or gummed in some way to make it non-stretchable.

A very common home-made indicator gear is used in Lancashire where there is a ceiling 8 to 12 feet above the engine. It is a long pendulum of flat wood about 5 inches by 1 inch or less, and is often simply forked to be placed over the crosshead. It is not accurate when thus used without the link *l* of Fig. 2, but I think it could be made so by the use of a Brumbo for the cord, having a longer radius than that proper to its place on the lever so taking up an excess of cord to counteract the reduced angular swing of the pendulum consequent on the improper connection at the crosshead. There is a danger in this, however, of getting the Brumbo out of place. Now the great beauty of this pulley is that when it is struck to the radius proper to the point of suspension you can swing it to any position and the cord is always properly led off from the pendulum. Without the pulley it is not merely that there is an error in the motion at its best, but the cord is apt to be led off at a wrong angle, as in Fig. 3, so completely disorganizing the proportions of the diagram.



ERRORS IN REDUCING GEAR.

One would like to ask why do makers of gas engines contrive so often to make it difficult to rig up an indicating gear? Is it that they do not wish the outsider to find out for himself how very much there is to be subtracted from the gross diagram in order to arrive at the net effect in power? Many gas engines are entirely too complex in their arrangement of working cylinder, air pump or closed crank case to permit of close indication except by a brake.

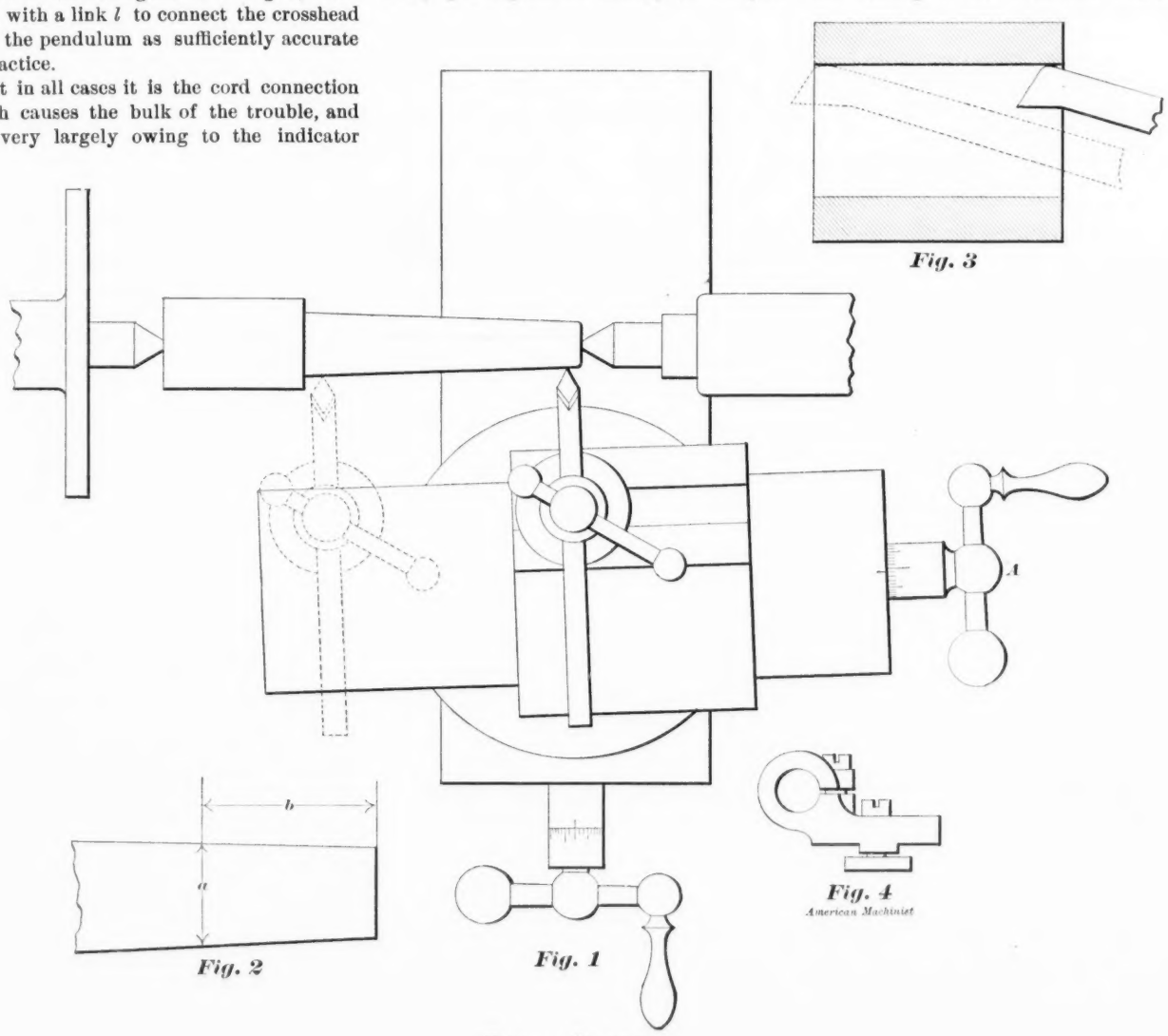
Some of the arguments of the gas engine men are a trifle curious; one such overheard by me a day ago had reference to the non-satisfactory working of the man's engine with an oil found quite suitable for another make of engine. You must not think, argued this man, that our engine will work with the stuff that Mr. X.'s engine can use; as though it were a proof of superiority in the engine that it needed a better oil

W. H. BOOTH.

Using Compound Slide-rest.

Editor American Machinist:

I have done considerable work on small lathes having removable slide-rests of the type shown in Fig. 1, but it is a difficult matter to set the swivel plate by the degree marks with sufficient accuracy for some jobs, and a great many slide rests have no degree marks at all. In turning up lathe centers or milling arbors this outfit is away ahead of setting over an engine lathe tailstock, for two reasons—the center holes are not worn out of shape, and the length of work has no influence on the taper—the same advantages, in fact, that you have with a taper attachment. Quite a common job is to have to turn up a blank for a shank mill, with an old shank or arbor as a sample from which to copy the taper. By putting the sample in between centers as shown in Fig. 1, and a tool in tool post, the rest can be set with comparative ease and certainty. The point of the tool should be at exactly the height of the centers, and brought up to the sample till you can just hear it touch, first at one end and then at the other while rotating the sample by hand on dead centers. Although not absolutely necessary it will be found to simplify matters if the slide-rest is placed at such a position on the lathe bed as will bring the pin on which the swivel plate turns directly in front of one end of the sample taper, as then any alteration of the swivel plate will have little or no effect on the reading of the cross-feed micrometer for that end of the work. The rest is first set as near to the taper as can be judged by eye, and placed relatively to the sample as shown in Fig. 1 when the reading of the cross feed micrometer is taken. Then the tool is fed along by means of feed-screw *A* to the other end of sample taper, and the swivel plate altered till the cross feed micrometer reads as before, when tool is in contact with work. If the tool is now fed back to its original position it may be found necessary to alter the swivel plate to a very slight extent in order to make the micrometer read alike at both ends, but do not do this while the tool is over the swivel pin. Take a fresh reading of cross-feed micrometer here, run the tool up to other end of work and then alter swivel plate there.



USING A SLIDE REST.

I have turned up tapers in one shop to fit machine tools in another shop, using this method of setting slide-rest, and the tapers generally touched all the way along without any filing being necessary. It may seem like a long process to those who have never tried it, but I think it is much quicker than trying the work in a hole or in a bevel gauge. I turned a taper in this way once where the sample ran out when placed on centers (it was a milling arbor that had been bent), and it ran out more at one end of the taper than at the other, but I took the mean between the readings at the high and low spots at one end, and made it come the same as the mean of the two readings at the other end, and the new arbor fitted O K.

As sort of a digression I might say it is sometimes required to make new tapers enter their holes a different depth from what the sample does. For instance the old lathe center don't enter its hole far enough to let the screw push it out. Suppose we sound the hole and find it would be well to let the new center go in $\frac{1}{4}''$ deeper than the old one. A good way to do this is to set the calipers to any part of the old taper near the small end, as at *a*, Fig. 2, and measure the distance *b* with a scale. Let *b* measure $\frac{1}{4}''$ more on the new work than on the sample.

Setting this style of slide rest to turn parallel can be very readily done by the same method as for tapers, only we do not necessarily need a parallel arbor to set it by. Any piece of turned work that runs true can be used by reversing it between centers, and always trying the tool against the same spot. But this has been discussed by several writers some time since in regard to engine lathe foot stocks, so I do not advance it as a new idea.

Setting it to bore an exactly parallel hole can be done by first taking several cuts through the hole, the last ones very light, so as to eliminate any spring of tool. If the tool is now set so its outer end will touch the other side of the hole, as in Fig 3, and the contact tried at both ends of the hole, any deviation from parallelism will be *apparently doubled*. I generally turn the cross-feed screw till I can just hear the boring tool rubbing against the back of the hole while lathe is running, and then read the micrometer. Those not fortunate enough to have the hubs of their lathe screws graduated can use a chalk mark with good effect, as what we wish to know is whether or not the cross-feed comes to the *same* position for each end of the hole, and a chalk mark will do this about as well as graduations, although the latter will tell us the amount of deviation from parallelism which the chalk mark will not.

I have long since discarded forged boring tools, and have adopted a smooth round bar with small inserted cutter in outer end, except for small sizes, where I use a piece of drill rod with forged lip. The bar is held in a fixture, Fig. 4, that goes on slide rest, and split bushings are used to hold the small sizes of rods. I claim no originality on this boring tool holder, as I got the idea from articles by Messrs. Ross, Armstrong and Bell Crank that appeared in this paper about two or three years ago. Besides being a first-class all around boring tool, it has the merit of being used with equal facility upside down when necessary, and this is often quite an advantage. In fact, I turn the bar over in the holder when testing for parallelism, letting the cutting lip touch the back part of hole, instead of setting the tool at an angle as shown in Fig. 3 We sometimes have chuck work with an outside cone that has to fit a conical hole. By turning the plug with the tool on the front, and the hole with the tool on the back, both can be turned with one setting of slide-rest, and the cones will be sure to match without regard to any degree marks on swivel plate. Of course it is necessary to see that the cutting point of tool is in each instance at the exact height of the centers.

Sometimes the slide-rest will be found to bore so nearly parallel that it couldn't very well be doctored any without the chance of making it worse, only it tapers the wrong way. The taper can be reversed in direction without changing its amount by turning the boring tool over and cutting on the back side of the hole. I have seen work that required two holes bored in it at one chucking, each slightly tapering the same amount, but in opposite directions. This can very readily be done by turning the boring tool over for one of the holes.

WALTER GRIBBEN.

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NEW YORK, SEPTEMBER 28, 1893

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Headquarters at the Fair.

During the continuance of the Chicago Exposition the AMERICAN MACHINIST will have its headquarters in the space allotted to the Mechanical Press in Machinery Hall. The exact location is Section No. 27, Column K 37. Word can be left with the attendant there by any one who is desirous of meeting a representative of this paper, who may at the time be engaged elsewhere on the grounds. As the majority of our friends who visit Chicago during the continuance of the Fair will spend a considerable portion of their time in Machinery Hall, we invite them to make use of our facilities there by having their mail addressed in our care as above, where it will be cared for and delivered on demand either by our own representative or by the person who cares for the space in which our desk is located.

What the Roads Seem to Need.

At this writing the latest horror is the killing or maiming of about thirty persons on the Big Four system, the second section of a passenger train apparently being run absolutely as though there were no first section in existence, and running into it at nearly full speed on a straight piece of track where, for two or three miles, the view was uninterrupted.

So thick and fast have the disasters come this summer, however, that we cannot help feeling that the chances are that before these words reach the eyes of our readers there may be others still more terrible.

In the feeling of horror and desperation naturally aroused by the thought of all this apparently needless suffering, the natural tendency is perhaps to conclude that there must be increased supervision by governmental authority. For it seems to be demonstrated that for some reason or other, probably mainly because the real owners of railroads do not manage them, but only hamper those who do, the roads will not, or cannot, take measures necessary to reasonably protect even their own property, much less the lives of those who must travel by them.

Competition is much more open and free between vessels plying the oceans and our great lakes than it can ever be between railroads except for through traffic between important centers; and yet, notwithstanding the complaints of some of the roads of too much interference, there is not a tithe of the governmental supervision of the actual operation of railroads that is exercised over the navigation of steam vessels. It is safe to say that if there was proportionately as close supervision over the management of railroads as there is over steamboats, the number of accidents would be far less and the companies would be at least as well off as now. Of course it is true that the companies dislike these accidents—they are expensive and hurtful to business, especially at a time like this when people are traveling in large numbers for pleasure only, and can stay at home when the fear of being killed bids fair to spoil their pleasure; but this does not seem to be enough, and a supervision analogous to that which requires every engineer, captain, or pilot of a steamboat to take out a license, which prescribes how the vessel shall be constructed and fitted, limits the steam pressure in the boilers, the number of passengers and amount of freight carried, and specifies what shall be provided in the way of safety devices, seems to be demanded.

The Obstructionists.

It seems to be true in finance, even more than in mechanics, that there must be some uniform, unvarying standard of comparison. Nothing is so much to be feared in commercial circles as an impending change of values, or of the standard by which values are to be determined.

Probably nine-tenths of those citizens of the country who have given any intelligent study to the matter are agreed that there should be but one standard of value, and that this standard should be that which is also the standard of other commercial nations. Gold answers this description, and is the only thing that does answer it, and there can be no doubt that we must eventually retain it, not necessarily as our exclusive circulating medium, but as our standard of value or comparison. There is an overwhelming popular demand for the repeal of the Sherman silver law—such a demand as will eventually bring about its repeal in spite of all obstruction, but for the present we have the edifying spectacle of a few men in the Senate attempting to defy this public sentiment. They might as well attempt to breast Niagara, but in the obstructive course they are now pursuing, they are at least managing quite effectively to hold up business.

Taxation of Pay Checks.

During the recent extreme scarcity of currency, when money was at a high premium, some of the Hartford manufacturing concerns, rather than shut down or let their workmen go unpaid, paid them in what were called "pay checks," which were so drawn as to pass current among the merchants of Hartford.

Among the firms adopting this plan were, we believe, the Billings & Spencer Co., Pratt & Whitney Co., Pratt & Cady, Pope Manufacturing Co., and others. Such checks were issued for about three weeks only, and no one pretends but that their issue was not only a proper thing, but very commendable, avolding much inconvenience to the workmen and tradesmen of Hartford.

But it seems there was a zealous federal officer on hand to see that the laws respecting taxation were strictly enforced. He conceived the idea that these checks were taxable under a law which no member of Congress probably ever thought to apply in such a case, and by sending a specimen of the checks of the Billings & Spencer Co. to Washington, got a decision that such checks were taxable at 10 per cent. of their face, to be paid by the makers.

We suppose no executive officer is to be blamed for enforcing the laws as he finds them; but, nevertheless, we don't think there would have been much blame in this case if the official had conveniently closed his eyes to that particular beneficial, though still technical, violation.

And we are quite sure that the law which imposes a 10 per cent. tax upon such issues made for such a purpose, and without profit to those issuing the checks, ought to be promptly amended or repealed.

It is said that about $200,000 in such checks were issued in Hartford, 10 per cent. of which would be $20,000, which the manufacturers may have to pay for doing an altogether commendable thing.

A special law of Congress should be passed remitting this tax, if that proves the only way of avoiding this injustice.

Put a Competent Man in Charge.

One of the things that may be learned by any one who goes very much about the exhibition at Chicago is, that if it pays a machinery man to go to the expense of exhibiting there, it will pay him to have a competent man in charge of the exhibit. As a general thing visitors, even those directly interested in machinery, will not take the time needed to themselves search through an exhibit and find just what its new or specially meritorious points are, even supposing them to be capable of doing it at all, which many of them are not. Just here comes in the value of a man who, not only thoroughly understands the machinery he has charge of, but is also acquainted with all similar machinery and has the necessary tact and faculty for putting things in the most favorable light.

The machine builder who goes to the expense of exhibiting, and then allows himself to be represented by some one little acquainted with the machines and incapable of properly presenting their merits if he did understand them, might better have staid at home and saved his money for use in other directions, for in many cases the impression made upon a visitor by an incompetent attendant is very unfavorable, the builder thereby unconsciously doing himself and his products a grave injustice.

People attending the Fair usually have a limited time in which to see it; when they approach an exhibit it is usually with the object of finding out whether it has any features of interest to them, and if so what those features are. They have a right to expect that the man in charge will put them in possession of this information without waste of time, and in a courteous manner. Failing this, experience shows that they will conclude there are no special merits to be presented, or, at least, none that interest them, whereas the right man in the right place might easily have scored a point in his employer's favor.

A mistake commonly made by many of those in charge of exhibits is to conclude that because a majority of those who ask questions are not those whom it will pay to spend much time with, none of them are, except those who take considerable pains to prove it, and it is quite a common thing for visitors to be rather repelled by answers to their questions based upon the assumption that the questioner is a mere general sightseer, not competent to understand or appreciate a correct and complete answer.

Those exhibitors of machinery who have something of genuine interest, especially if it be new, are, other things equal, getting the best results from the opportunities the Fair offers for extending acquaintances; but no one gets the full benefit who has not some one in charge willing and competent to present the merits of the exhibit in the best manner.

A Recommendation Concerning Coal.

The Retail Coal Exchange of New York has "recommended" an increased price for coal of 25 cents per ton, to take effect October 1. It is contrary to law for the members of this exchange to order or dictate a higher price, and the members of the exchange are, of course, not merely law abiding, but are among the solid citizens, conservators of society, and uncompromising enemies of anything like disregard of laws, *i. e.*, anarchy. So they only "recommend" this increase in the price of coal, though it is needless to say that the recommendation will be universally acted upon, and the dealer who should imagine himself to have the liberty of choice as to whether he should or should not follow it would speedily find himself in hot water if he attempted to act upon any such supposititious freedom.

The well to do who have money and space for storage of coal will lay in a supply before the "recommendation" takes effect, those who have neither and must buy coal in small quantities as needed for immediate use will have to pay the increased price, and thus are the poor again shown the blessings of poverty, and how our modern civilization "protects the weak from the encroachments of the strong."

One of the thrifty schemes which, if all told, would make the Fair managers famous as long as the great exhibition is remembered, had its outcome on a recent Sunday. The attendance on this day of the week is very small because full price is charged for a small part of the show, a good many of those attending doing so to see the Art Gallery exhibits. On the Sunday referred to it was found that the free drinking fountains in the vicinity were closed, and that the venders of hygeia water were taking a holiday. To assuage their thirst the visitors broke open the hygea reservoirs and helped themselves. The next day considerable stir was made about closing the free drinking fountains in this and other parts of the ground—fifty in all—when it was frankly admitted that they were closed because being so near the hygeia stands as to interfere with the sale of that water. And yet the Fair managers and others wonder at the un-

complimentary way in which the management at Jackson Park is spoken and written about As a matter of fact the hygeia water is cheap enough at one cent a glass, and we should certainly advise people to drink it instead of taking chances of what they are drinking at the free fountains. It is not the question of the penny a glass that troubles people; it is the being bludgeoned into paying the cent that makes the talk.

QUESTIONS AND ANSWERS.

Questions of general interest relating to subjects discussed in our columns will receive attention in this department. The writer's name and address should always accompany the question. Neither correct initials nor location will be published when there is a request to that effect. If questions are enclosed with a business communication, they should be written on a separate sheet.

(474) J. C. K., Muncie, Ind., writes: Please inform me where I can find a good book treating on mechanical drawing. *A.*—The series of articles on practical drawing published in our columns, we believe will suit you. We can furnish you with all these back numbers.

(475) A. B., ———, writes: I would like to know how steel balls for ball bearings are made. If it has been described in your columns please give me the date of issue. *A.*—A general description of the manufacture of steel balls is given in our issue of April 18, 1889, under the head of "Fitchburg Shop Notes," page 6.

(476) E. E. D., Wilmington, Del., writes: I have served my time (5 years) in a machine shop and am now out of work. I desire to enter the U. S. Navy as a machinist. Please inform me to whom I shall send my application, and the requirements to enlist. *A.*—Send your application to the engineer-in-chief of any navy yard. If there are any special requirements for entering the navy he will undoubtedly inform you of them.

(477) G. T. H., New York, writes: Kindly give me a formula for mixing acids to make a dip for brass castings. *A.*—If you refer to a solution for cleaning new brass castings, see answer to Question 466 in our issue of September 21, current volume. 2. Is there a machine in the market for buffing large pieces; if so please inform me who makes it? *A.*—The Norton Emery Wheel Co., Worcester, Mass.; Warner & Swasey, Cleveland, O., and probably several others of our advertisers make these machines.

(478) R. H. D., LaFayette, Ind., writes: Please inform me whether there has been any work published treating on case-hardening cast-iron. If not, where can I get instructions on the methods used? *A.*—We do not know of any book which treats on this subject, and believe there is none. In our opinion it is very difficult, if not impossible to case-harden cast iron. It has been claimed that the surface of cast iron can be made very hard by using prussiate of potash, and heat and cool three or four times, using potash each time We do not know where you can obtain instructions on this subject.

(479) A. F. G., Paisley, Scotland, writes: Some years ago we observed an American publication of exhaustive series of articles by Joshua Rose on hammering of plates and saws. We remember that he also wrote one or two articles in your paper about 1881, and we would be very glad to know if the more exhaustive series of articles were ever published in book form, or if you could give us the name of any book giving us information regarding the hardening and tempering of saws. *A.*—The articles to which you refer have not been published in book form. Literature on this subject is scarce, we do not know of a book that we could recommend.

(480) G. W. C., New York, writes: Kindly inform me, what is a hyperbolic logarithm. I have run against this two or three times lately, and can find no explanation in Davies' Legendre, nor in my academy books. The only thing I find in my library is in Pray's Twenty Years With the Indicator. *A.*—Hyperbolic logarithm, Napierian logarithm or natural logarithm are names given to the same system of logarithm. The base of the system of hyperbolic logarithm is 2.718281+. It derives its name from its measuring the area between the equilateral hyperbola, an ordinate, and the axes of co-ordinates when these are the asymptotes. You will find this system, as well as the common system of logarithm, explained in Davies' New Bourdon, or in Loomis' Algebra.

(481) W. H. P., Buffalo, N. Y., writes: I am about to manufacture dampers out of sheet steel or iron. I would like to know what I can use to stain or color them black, that will be cheap and can be used as a dip without leaving much drip, something that will also prevent them from rusting. *A.*—The following solution for producing a dark color on iron and steel has been recommended: Ferric chloride, 10 parts; water, 200 parts; potassium sulphide, 1 part. The articles may be immersed in the solution or painted with it, then allowed to dry by exposure to the air, and finally brushed with a waxed brush; a fairly good black bronze may be obtained in this way. This solution, with the omission of the potassium sulphide, may be used for bronzing iron or steel. The color is brown after two immersions, with subsequent air drying, and uniformly distributed over the surface. A dense and fairly uniform grayish-black color can be produced on iron by digesting flowers of sulphur with turpentine, painting the work with the liquid, allowing to dry, and then heating over a clear fire, or on a hot stove. The foregoing has been taken from "Metal Coloring and Bronzing," by A. H. Hiorns.

(482) B. E. W., Three Rivers, Mich., writes: We have a steam drum 42 inches long and 23 inches inside diameter. Now we wish to put in two cast-iron heads. Please explain and give formula in full for finding the required thickness of metal with a steam pressure of 150 pounds per square inch. *A.*—The thickness can be found by the following formula:

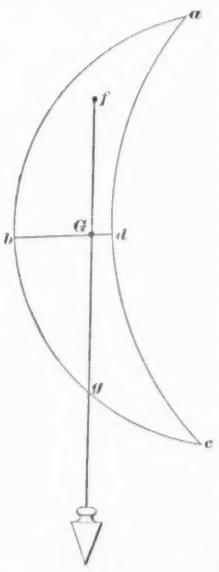
$$t = \sqrt{\frac{5 \times r^2 \times p}{6 \times f}};$$

in which t denotes the thickness in inches, r the radius in inches, p the pressure per square inch, and f the safe working stress of cast-iron, which for this purpose we may take at 2,500 pounds. Applying this formula for finding the thickness of heads in your case, we have $r = 11.5$, and $p = 150$; substituting these values for the symbols in the foregoing formula, we have:

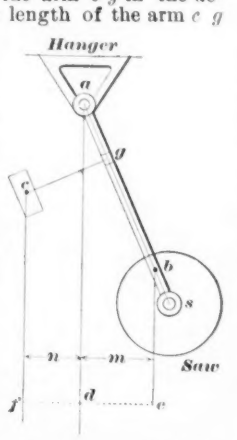
$$t = \sqrt{\frac{5 \times 11.5^2 \times 150}{6 \times 2\,500}} = 2.57 \text{ inches.}$$

Here we have assumed that the head has no braces, and is not ribbed. Of course, when ribbed the thickness can be reduced. We have also assumed that the heads are flat or nearly so. 2. Please give me the standard method of testing single plate wheels with chilled treads. Have you ever treated on the design and molding of single plate chilled car wheels in your paper, if so what is the date of the paper? *A.*—We have published an article treating on molding chilled car wheels, by S. Bolland, in our issue of December 15, 1892; in this we believe you will find the information you seek.

(483) A. W. S., Brooklyn, N. Y., writes: Kindly inform me how to determine the center of gravity of a figure a, b, c, d, the radius of the arcs being given. *A.*—Cut a template to any scale to the form of the figure. Since it is symmetrical the center of gravity will lie on the center line $b\ d$, which, if prolonged, will pass through the centers from which the arcs have been described. Suspend freely the template from any point, as f, and from the same point suspend a plumb line; the point G in which the plumb-line crosses the center line $b\ d$ will be the center of gravity. The template may be suspended in succession from several other points chosen at random; the plumb-line suspended from the same points must pass through the point G, if not there is inaccuracy somewhere. The center of gravity may in many cases fall outside of the arc $a\ d\ c$, but this will not make any difference in the foregoing method of finding the center of gravity. All that need to be done in cases of this kind is to draw on the template a line $f\ g$ coincident with the plumb-line as far as the template will allow; after that fasten the template to any plane surface, and continue the line $f\ g$ on this surface; also draw the center line $b\ d$ to meet $f\ g$; the point in which these lines intersect will be the center of gravity.



(484) W. T. S., Providence, R. I., writes: I have a swing saw frame that I wish to counterbalance. The frame is about 8 feet long and I want to put a weight at c, as shown in sketch, about 2 feet below the upper support a, so as to swing the frame out of the way and hold it there. Please give a rule for finding the weight in the counterbalance at c. *A.*—Draw the frame $a\ s$ in a position which it is to occupy when out of the way; also draw the arm $c\ g$ in the desired position. The length of the arm $c\ g$ is, of course, arbitrary and must be established to suit your ideas. Assuming now that the position of the center of gravity c of the weighth as been fixed; then through this center and also through the center of support a draw vertical lines $c\ f$ and $a\ d$ of any length. Through the point b, the common center of gravity of all the parts of the mechanism which swinga round the center a and which are to be balanced, draw the vertical line $b\ e$. Lastly, draw a horizontal line intersecting the vertical lines in the points f, d, e. Now for equilibrium of the parts in the position as here shown, the distance $f\ d$ in inches multiplied by the weight c in pounds must be equal to the distance $d\ e$ in inches multiplied by the weight in pounds of the parts which are to be counterbalanced. This condition of equilibrium can be expressed in symbols as follows: Let n denote the distance $f\ d$; m the distance $d\ e$; c the weight of the counterbalance, and b the weight of the parts to be counterbalanced; we then have



$$n \times c = m \times b.$$

If now the values of n, m and b are known, the weight c is easily found from the foregoing formula. If, for instance, the weight of the parts whose center of gravity is at b is 500 pounds, and the distance m is 24 inches, and the distance n is 12 inches, then we have

$$12 \times c = 24 \times 500,$$

consequently $c = \frac{24 \times 500}{12} = 1{,}000$ pounds.

Here we have taken the length of the arms in inches, but we could have obtained the same results by taking these lengths in feet. We could also have taken the weights in tons without changing the result; but it should be remembered that whatever unit of measurement or unit of weight we adopt, these must not be changed during the solution of a problem. It should be mentioned that in the foregoing the weight of the arm $c\ g$ has been neglected. 2. In which books will I find the solutions of similar problems? *A.*—Any good book treating on mechanics will give the principles upon which the solutions of such problems are based. Of course the applications of these principles you will have to make yourself.

(485) F. C. S., Guilford, Conn., writes: In a recent issue of your paper I ran across some information which was confusing, and I take the liberty of asking an explanation. You answered a correspondent who inquired for a rule to find the diameter of a pipe 6 feet long filled with oil that will have a pressure of 2 pounds at the base. I know that a difference in diameter of the pipe produces a difference in pressure of the liquid contained, yet in your answer to another question (428) the diameter of the pipe is not taken into account. I cannot understand why this is necessary in one instance and not in the other. *A.*—A careful perusal of these questions will show that in the first one the pressure on the whole surface of the lower end was required, we therefore had to take the diameter into account In the second question, the pressure per square inch of surface at the bottom of pipe is given, which will not be affected by the diameter of the pipe, and therefore was left out of consideration. If the pressure on a surface of a given area is required, then multiply this area in square inches by the pressure per square inch, the product will be the pressure on the given surface. 2. You state in reply to Question 239, in your issue of May 28, 1887, that the distance on the scale remains the same so long as the inside diameter of pipe equals that of the glass tube, while in your reply to Question 89, February 25, 1888, you say, "but the length of the scale will not be changed by changing the diameter of the glass." This appears contradictory, yet you will probably be able to make a clear explanation. *A.*—Our correspondent refers to a siphon gauge in which a column of water balances the air pressure. It consists simply of a wrought iron tube bent to a U shape with a vertical glass tube attached to one end to show the water level, with a scale fixed alongside of it on which $13\frac{7}{8}$ inches indicate a pressure of one pound. A careful perusal of the description of the construction of this gauge and a little study will show that for a scale of this kind the inside diameter of the glass tube must be equal to the inside diameter of the iron pipe, because in this case the fall of the water level in one leg must be equal to the rise of the water level in the glass tube; if the inside diameter of the iron tube is larger or smaller than that of the glass tube, there will be a difference in the fall and rise in the water levels, and under these conditions the scale would have to be changed to suit these conditions. In this answer we also state that this scale is suitable for any diameter of glass, provided the inside diameter of the glass is equal to that of the pipe. In the answer to the second question to which our correspondent refers, we state the same thing, namely, "that the length of scale will not be changed by changing the diameter of the glass." We see no contradiction in these answers. Your other questions will be answered soon.

BUSINESS SPECIALS

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Ideal Drawing Stands. M. C. Hammett, Troy, N.Y.

Forming Lathes Mer. Mach. Tool Co., Meriden, Ct.

6-Spindle Turret Drills. A. G. Quint, Hartford, Ct.

Milling Machs. Kempsmith M. T. Co., Mill., Wis.

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"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator and making all required calculations from the diagram, also the principles of economy in operating steam engines and current practice in testing engines and boilers. Price, $2 postpaid. Published by John Wiley & Sons, 53 East Tenth Street, New York.

An Engine Standard and Cylinder Pattern—II.

BY J. HORNER.

The box for the main core for the standard is shown in Fig. 14. It is a half box, both halves of the core being symmetrical. Each half is rammed separately in this box and the two struck together before being put into the mold. The main box is framed together with sides $A\ A$, grooved in ends B B and bottom board C, forming a skeleton within which the precise outlines and various parts of the box are fitted. The various parts are as follows:

The front end of the box is fitted with blocking D to make the dimensions there correspond with the dimensions of the print $N\ N$ in Figs. 8, 9 and 11 (see previous paper) that is the thickness n, the length n', and half the depth $n\ n$, similarly lettered in both sets of figures. Beyond this there are pieces fitted within the sides of the box and cut to the longitudinal and the transverse curves of the internal portions of the standard, corresponding with the transverse sections given at various localities, as in Figs. 1, 2, 4, 7. It is necessary to work these as carefully as the external portions of the pattern, other-

wise the thicknesses for metal will be found to vary when the core is put into the mold, and as these castings are made very light, the thicknesses not exceeding $\frac{1}{2}''$ or $\frac{5}{8}''$, slight inaccuracies would be very marked.

The principal fitting on the bottom board *C* is the piece *E*. This corresponds in area, outline and position with that of the recessed flat piece *v* on the pattern, Fig. 8, and forms that portion of the core which rests upon the portion of the mold formed by the flat piece *v* in the pattern. The curved side pieces *F, F, H, H* in the box, form the internal curvature of the column, shown by dotted lines in Fig. 1.

At the top end of the box the flat piece *E* terminates at *e'*, and the portion between that and the end cross-bar *B* is blocked up and worked to a semi circular form, corresponding with the interior portion of the casting *t* in Figs. 1, 2, 4 and 8. One half the stuffing box *K* and its print *k'* is screwed in the center to the end cross-bar. The portion marked *z* in Fig. 2 is also worked in the box at *z*.

At the lower end of the box the portion between the print *D* and the flat piece *E* is fitted with sweeped pieces *H H* and *J*, whose longitudinal and cross sections correspond with the similar sections of the casting in that locality. A template like Fig. 15 is used for working the various transverse curves of *F F* and of *H H*, the edge *a* bridging across the joint edges of the box. The part *P* is recessed like the similar recess *P* behind the crank bearings *F* in Fig. 2.

There are two blocks *K K* in the box which form the concave guides—compare with Figs. 1, 2 and 5—*E E* in the casting for the slipper or cross head. These pieces *K K* form, of course, but one half guide each, their center lines corresponding with the joint edge of the box, or with the line *a—a* in Fig. 5.

Lugs *L L* are fitted in the box corresponding with those portions of the lugs *G* which come within the casting, compare with Figs. 1, 2 and 7. These complete the core box.

The core for the cylinder *A* and its stuffing box *K* is struck against the board in Fig. 16, and end *A* is thrust into the corresponding hole formed in the main core by the print *K* in Fig. 14.

The jacket core *c* in Figs. 2 and 3 is made in the box, Fig. 17, the first views being an outside, the second a sectional view of the box. This box is open at the sides, so that the outside of the core is strickled, the edges of the overhanging top and bottom pieces *A* and *B* affording the necessary guidance to the strickle. In order to permit free delivery of the central portion or body of the box from the core it is necessary to divide it into three portions seen in section in Fig. 17 *a*. The central part *C* is withdrawn from the core first in the direction of the arrow, and the projecting side pieces *D* and *E* are taken out afterwards in the direction indicated by their arrows. The three openings *a, a, a*, Fig. 17, are those through which the air is permitted exit from the core, compare with Fig. 2, and through which the core is removed from the casting. Afterwards they are closed by the top cover of the cylinder. The boss *f* is for the pet cock to pass through, seen at *f* in Fig. 3. The exhaust passage passes through the boss *g*, seen also in Fig. 3. The leading correspondences of the box with the casting are indicated by the similar reference letters in Figs. 2 and 3, as *a a* length, *b b* exterior diameter, *c c* interior diameter, *d d* thickness, *e e* length on one side, *f f* length on the other side.

The core box for the steam chest, Fig. 18, is rather intricate. I have drawn it to a larger scale than the other figures, the better to show its parts. The passage cores and a portion of the exhaust core were made in one with the steam chest core, in order to ensure closer accuracy and to prevent risk of insecure fixing and venting in the mold. This is a practice frequently adopted in work of this type. As a rule the less luting together of separate cores the safer.

The box is formed of two sides *A A*, two ends *B B*, and a bottom board *C*. The length *g g*, width *h h*, and thickness *j j*, respectively, of the print portion correspond with the similar length *g g*, width *h h*, and thickness *j j* of the print in Figs. 8 and 10. The length *k k*, width *l l*, and depth *m m* of the recess respectively of the steam chest in the box, Fig. 18, correspond with the similar length *k k*, width *l l*, and depth *m m* of the recess in the casting in Figs. 1, 2 and 3. The inner face *n n* corresponds with the inner face *n n* of the internal flange of the steam chest; *h h* are the steam passages; *j* is the exhaust passage similarly lettered in Figs. 1 and 2; *k k* are the facings for valve guides.

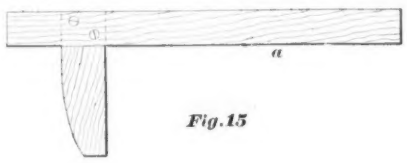


Fig. 15

Fig. 16

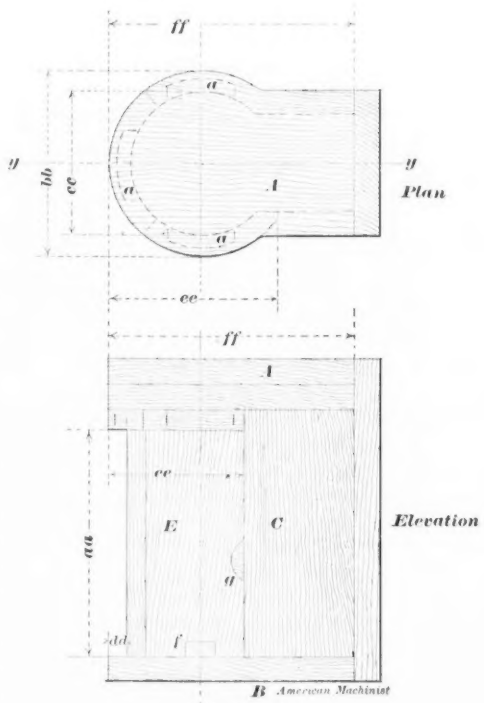


Fig. 17

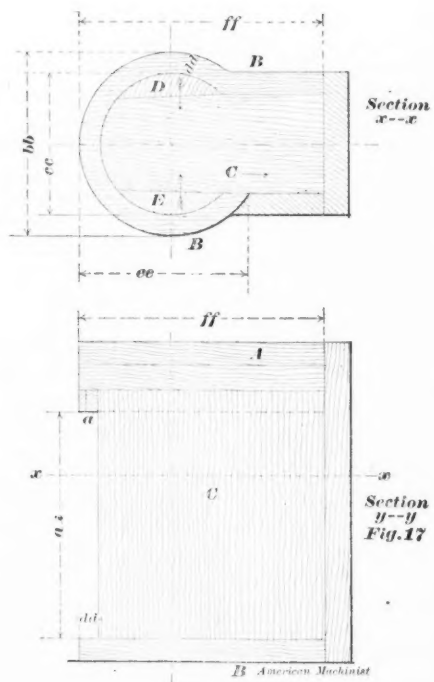


Fig. 17a

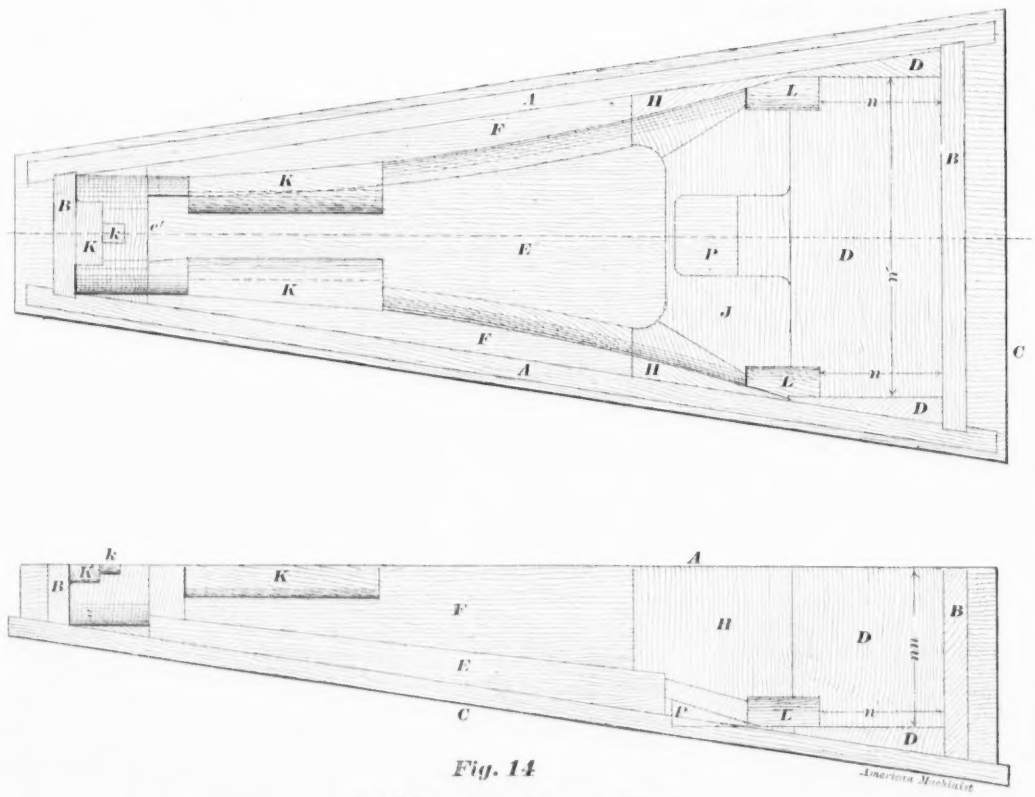


Fig. 14

AN ENGINE STANDARD PATTERN.

The box is put together in such a way that all the parts, while incapable of movement during ramming, shall be easily removable for the delivery of the core. The bars *l l* between the passages are let or recessed into the block *D* forming a portion of the body of the box, and are therefore incapable of movement, and the edges of their curves are kept intact. In order to ram between them the piece *E* above, which forms the upper bounding edges of the passages, and which carries the top valve, facing is made removable. This piece is removed in the plan view in order to show the passages clearly, curely while the passages *h h* are being rammed. At *F* the boss which forms the stuffing box for the steam chest—compare with Figs. 2 and 3—is fitted.

The core box, Fig. 19, cores out the bearings *F F* in Figs. 1 and 2, and the print for it is shown at *F* in Fig. 8. The box, Fig. 20, takes out the recesses *O O* in Fig. 2, and fits the print impression *O* in Fig. 8. Both figures are self explanatory.

Miss Bertha Lamme, of Springfield, O., recently received a degree of electrical engineer at the Ohio State University. She is said to be the first woman in the world to receive this degree, and led her class all through the course. She has already accepted a position with the Westinghouse Electric Company, at Pittsburgh.—*Electrical World.*

Wasted Energy.

A short time ago we had something to say regarding the waste of energy in inventing useless or worse than useless things. The following correspondence, copies of which have been sent us from a well-known manufacturing concern, shows that an engineer usually wastes energy and time in the effort to show one of these misguided individuals the error of his way. The engineer's letter to us is as follows:

Editor American Machinist:

"The writer read with interest an editorial in your issue of August 24th, titled 'Wasted Energy,' and it came in just at a time that the writer could appreciate the force of it, as he was just in correspondence with one of these 'wasters' at Dalby Springs, Texas. We first received a postal card from him and replied as per copy of letter inclosed, hoping to do him some good, but (like a great many others) my experience is that it does not do any good to attempt to choke them off. His reply of August 1st would indicate the impossibility of convincing him by any argument that any mechanic might advance, and the writer became tired and did not answer it.

"We inclose the whole correspondence to you. If you should keep an article in your paper of similar vein to that of 'Wasted Energy,' it could be read by a great many would-be inventors with profit.

"Yours truly,

L. G. S."

The postal card referred to reads as follows:

"DALBY SPRINGS, Tex.,

"July 27.

"S. E. Co.:

"I have a machine gear that will increase the amount of power applied to any *desired amount*. It is simple, durable, and neat. If you can't buy, help me sell. I am poor; will pay you for anything you may do for me. This is the world's greatest invention. I would love to sell. E. C."

To this card the engineer replied for the firm as follows:

"MR. E. C.,

"DALBY SPRINGS, Tex.

"DEAR SIR: We have your postal card regarding the power increasing machine, and would state that you are on the same track that hundreds of others have been ever since a gear or crank or any such mechanical appliances were discovered. It seems strange that in this enlightened age when the common principles of mechanics should be understood by even a schoolboy, that men will allow their minds to run to waste on such a mechanism as you describe. In the first place, there is nothing that can ever make power out of nothing. The power of a steam engine is based entirely on the area of the piston, the rate of its movement and the pressure of steam upon it. If an engine running with 250 feet of piston travel can deliver to any machinery by means of belt

or gearing 25 H. P. at a certain pressure of steam, and if the speed of this engine is doubled, other conditions remaining the same, you will get double the power. The only way the power can be increased is by increasing the piston travel or by increased pressure of steam, and all the mechanism you could apply to any machine to double its power would be entirely fruitless. You cannot make power out of nothing, and the sooner you cease experimenting on this line, the more time and money you will save. A man applying his strength to a 6″ crank and lifting a certain load by means of a rope around the shaft, will find that he can move it much easier if the crank is twice the length, but he is going through twice the space to accomplish it.

"We write you in this way because we are conversant with the bent of minds which are not thoroughly up in the knowledge of mechanics, and if any word of ours will prevent them from wasting their energy and cause them to divert it to some useful paths, we shall think we have been at least of some benefit to humanity, and we say—'Don't fool with it any longer.'

"Yours truly, S. E. Co.,
L. G. S."

"DALBY SPRINGS, Tex., Aug. 1, 1893.

"MR. L. G. S., the James Watt of *this day:*

"I thank you for your kind letter. No one but a great and kind man could have written such a letter. I note what you have said. Action and reaction are always *equal* and opposed to each other. I say that one-third of the power generated is lost in changing reciprocating motion into rotary motion; and in every round of the piston I have one-third more power, and in three rounds two times the power that I had when I started—I should say leverage, but leverage is power. I can increase the stroke to any desired length, and will give a working test to prove what I say. I will mortgage two thirds of this *machine gear* to have it patented in all countries where patents are granted, and to have it manufactured, or will give one half the machine, or I will sell the invention, with working test, for *one tenth its worth.* * * *

"E. C."

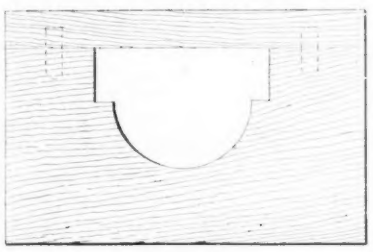


Fig. 19

New Small Arm for the Navy.

A Washington dispatch says: The adoption by the army of a new magazine rifle, to displace the rifles with which it has been armed for years, is to be followed by the selection of a new arm for the navy.

The Small Arms Board, which for weeks has been discussing the caliber of gun best adapted for naval purposes, has concluded that the army 30 caliber is not the gun for the navy, and has recommended a rifle of the remarkably small caliber of six millimeters, or of about 23½ caliber. The report of the Board was approved by the Chief of Ordnance and forwarded to the Secretary. He has just approved it. The Ordnance Bureau will now begin the manufacture of rifle barrels of this caliber, and will call upon inventors of the country to submit their inventions of breech mechanism and stocks to suit this caliber.

The adoption by the army of an arm of foreign invention will not control the navy, if it be possible to secure a rifle of domestic invention, and having every feature of value which the mechanism of the army gun possesses. The Board, in determining upon the caliber, was influenced by the greater value to the service of a gun with smaller caliber than that of the army, rather than by the advantages of having the rifles of identical size, with a view to the use of interchangeable ammunition. This advantage was not overlooked, but it was decided that the occasions for the use of interchangeable ammunition were so rare as not to warrant sacrificing what the Board thought was a superior type of gun.

The Board finds that the smaller caliber rifle has many advantages over the Krag-Jorgensen gun of the army, which is of 30 caliber. These are: Flatter trajectory, which will do away with sights; greater velocity and necessarily greater range, lighter ammunition, and greater accuracy. Some barrels for tests at the ordnance shops here are now being manufactured of this caliber. The bureau will also experiment with a barrel manufactured of steel, with 25 per cent. of nickel.

Under the plans of the department the navy will furnish the barrels and ammunition, and the inventor who shows the best breech mechanism will supply the stock and all other parts.

Fully 5,000 rifles are necessary to supply the enlisted force of the navy.

In view of the frequent failure of large fly-wheels of late, the attention called to the matter of the fastening together of the sections of such wheels by Mr. Charles T. Porter in his recent paper presented at the Chicago meeting of engineers and published in our issue of August 10, is opportune. Mr. Porter's conclusion was that in many such wheels this fastening is inadequate, and we believe he is quite right. The reason for this may very likely be that there has been a gradual increase in the speed of so called slow speed engines, and the fastening together of the sections remains about as it was. The old conventional speed of fifty or sixty revolutions is something of the past, and has not been met, as it should have been, by correspondingly stronger wheels. The matter is serious enough to call for immediate attention, even if some wheels now in use are broken up and replaced by stronger ones, unless they can be strengthened. When a fly-wheel goes to pieces it is likely to do a good deal of damage to property, and result in loss of life, as in a quite recent instance. Of course no builder of steam engines would knowingly let an unsafe wheel go with one of his engines, but there is certainly the necessity for the application of a little arithmetic to the fastenings of some wheels that do go into use.

An accident, the exact nature of which is at this writing somewhat uncertain, occurred on board the "Montgomery," a recently completed naval vessel built by the Columbia Iron Works, by which the chief engineer of that establishment, Zacharia Menshaw, was scalded so badly by steam that he died within a few hours. The boat was undergoing her third private trial trip at the time, being still in the hands of the builders.

To judge from what can be made out by the press reports, a steam pipe gave away, and the valve, whose position was unknown to most of those aboard the boat, was besides not readily accessible, and for about an hour the steam rushed forth before it could be stopped.

Good Steel.

When mechanics read of steel shells 8″ diameter, and weighing 300 pounds each, being fired through steel plates 9″ thick, oil tempered, and specially made with a view to resistance, they naturally think of the advantages that might result from the use of such steel for punches.

When ordinary untempered steel is to be punched we usually consider that it ought not to be much thicker than the diameter of the hole, and that the speed at which the punch passes through the steel should be very slow. Here is a punch that goes through oil tempered steel, thicker than its own diameter, at a speed of 1,624 feet per second, or at least 3,000 times as great as is considered proper for punches used in punching machines, and the report says the shell was scarcely scratched, and that its point was intact. Of course, we know that this same shell could not be depended upon to make as many holes in this manner as a punch is expected to make, but it is also quite certain on the other hand that a shell made of such steel as is usually put into punches, and tempered in the same manner, would go all to pieces upon striking a tempered steel plate. It seems pretty certain that the army and navy are using steel that is far superior to that which is ordinarily used in industrial operations.

It may also be true that there would be relatively little demand for this high grade steel in shops, seeing that so many of them now pay altogether too much attention to the price of steel per pound, and too little to the saving that might be made by using a higher grade at two or three times its price.

Naval Contractor Hichborn, in a series of articles on Sheathed and Unsheathed Ships, in the *American Shipbuilder*, states that, "From July 1, 1880, to July 1, 1887, our naval vessels consumed about 327,500 tons of coal at an aggregate cost of nearly $2,500,000, which gives an average of 46,775 tons at a cost of $357,143 annually." According to these figures the price per ton is about $7 63.

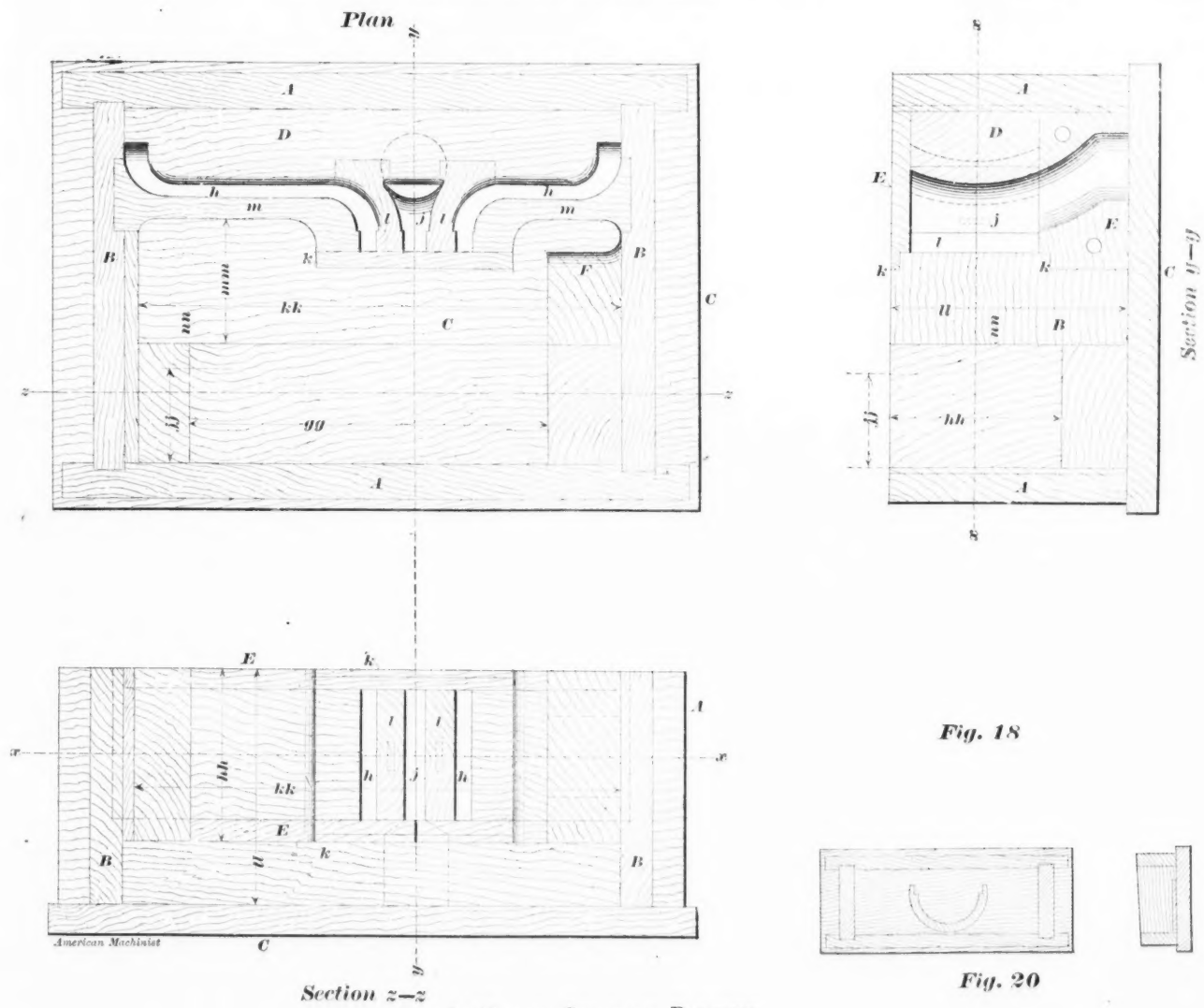


Fig. 18

AN ENGINE STANDARD PATTERN.

Fig. 20

MANUFACTURES.

The Taylorsville (N. C.) Cotton-mills will add machinery.

T. S. Dowse will establish a planing-mill plant at Ontario, Cal.

A new stove foundry plant may be established at Pittston, Pa.

An addition is being made to car shops at Elkins, W. Va.

The Lawrence Belting Co. mill, at Millville, Mass., is to be enlarged.

The Forbes Fiber Co., of Jersey City, N. J., has been incorporated.

W. N. Seay will rebuild his burned planing mill at Buena Vista, Va.

W. B. Woodruff will rebuild his two burned sawmills at Empire, Ky.

Klug, Baches & Stoll, of Milwaukee, Wis., will erect a brass foundry.

J. J. Morris will erect a saw-mill plant at Byrd's Switch, near Salisbury, Md.

R. C. Strangman will locate a bottling establishment at Washington, N. C.

Stone & Milligan will erect a $20,000 mercantile building at Lake Charles, La.

John D. Elliott, of Henderson, will erect a tobacco factory at Owensboro, Ky

The Breithraupt Leather Company will erect a new building at Listowell, Can.

A new boiler is being added to the Farnsworth woolen-mill, Lisbon Centre, Me.

Skeeky, Owen & Co. will immediately rebuild their burned tannery at Rankin, Pa.

Tillott Wood will rebuild his recently burned cotton ginnery at Hampstead, Tex.

H. K. Colkitt, of Vincennes, N. J., will establish a last manufactory at Memphis, Tenn.

It is very probable that another cotton factory will shortly be erected in Columbia, Ala.

A cotton house, 48x24 feet, will be erected at Lord's twine-mill, West Kennebunk, Me., at once.

The Whitman & Barnes Manufacturing Company will rebuild its burned reaper works at St Louis, Mo.

The Manor Big Vein Coal Company has been organized to develop coal mines near Shaw, W. Va.

W. L. Grant & Sons will rebuild their burned wood-working and machine shops at White Plains, Ga.

Work will shortly be commenced on the enlargement of the Phœnix Iron Works plant at Meadville, Pa.

The Springfield (Ill.) Boiler and Manufacturing Company will increase its capital stock from $78,000 to $178,090.

The Ætna Standard Mill, at Bridgeport, O., resumed work on the 20th. The mill employs over 1,000 men.

The Troy (N. Y.) Nickel Works Company will erect a large plant on property recently purchased at Mechanicsville, N. Y.

The Everett Glass Works at Bedford, Pa., which have been idle for the past three months, started up the 14th inst., giving work to 100 men.

The York Rolling-mill, York, Pa., after a suspension of several months, started up in full the 18th. Between 300 and 400 men resumed work.

The large puddle-mill of the Glasgow Iron Company, at Pottstown, Pa., resumed operations on the 18th., giving employment to a large number of hands.

The Midland Manufacturing Company, of North Topeka, Kan., is adding a brass foundry to its works beside making other additions and improvements.

The Buffalo Heating and Ventilating Company has commenced the construction of its plant, near Buffalo, and will be ready to begin business early in November.

The five woolen-mills of the Rodman Manufacturing Company and the Gregory Mills, at Providence, R. I., started up on the 18th., after a shut down of eight weeks.

The site of the burned Fort Pitt tannery at Braddock, Pa., has been purchased by the Braddock Wire Company, which will erect a mill for the manufacture of billets.

The Lakeside Nail Mills, at Hammond, Ind., which have been closed since July, started up on the 18th., with their full force of 250 men. The company will soon increase the force to 400.

The McShane Company will begin building their new factories at Rahway, N. J., as soon as they can reach a satisfactory understanding with the Pennsylvania Railroad Company, with regard to freight rates.

It is reported that the Industrial Works, of Bay City, Mich., the most important manufacturing concern there, will start up this week, after being shut down for six weeks. The works employ about 300 persons.

The Bellaire (Ohio) Riverside and Wheeling Iron and Steel Company's works in Bellaire and Benwood, West Va., after ten weeks' stoppage, have started. Work will be continued while orders last giving employment to 5,000 operatives.

The Remington Arms Company's works at Ilion started up on the 18th., working full time with a full set of hands, after more than a month's shut down to half time with a small force. Sporting arms and bicycles are the goods to be manufactured.

The S. S. White Dental Instrument Works at Princess Bay, Staten Island, the largest in the world, have resumed operations, and are running on full time. The Baldwin-Douglass Wall Paper Factory at West New Brighton has also started up again.

Four mills at Holyoke, Mass., which have been closed or partly so for some days, resumed work with full force on Wednesday. They are the Riverside, Linden, Holyoke, and Connecticut River paper-mills. There are already indications of a busy fall and winter season in the paper-mills.

The rapid development of South Africa is creating a good and constantly increasing demand for American machinery. The J. A. Fay & Egan Co., Cincinnati, have recently sent to Algoa Bay one of their well-known large and heavy Band Resaws having a capacity of over 40,000 feet per day.

The Mount Vernon Cotton-mills, at Baltimore, Md., have resumed operations. The mills shut down for two weeks for repairs to the machinery. It was stated at the company's offices that the outlook for trade was good and that there were sufficient orders ahead to keep the looms buzzing for some time.

At Carlisle Pa., the silk-mill which closed several weeks ago on account of the hard times, throwing a large number of operatives out of work, resumed on the 14th, with plenty of orders on hand. The big car works, after being closed down for several weeks on account of tightness of money, opened at the same time. Several large orders for cars have been received.

The Penberthy Injector Company, of Detroit, Mich., have commenced the publication of what is called "The Penberthy Bulletin." It will be issued monthly, primarily, of course, to make the merits of the Penberthy Injector known, but will also contain other matter of interest to engineers, taken from various trade journals. It will be sent to any engineer who will forward to the company his own and his employer's address.

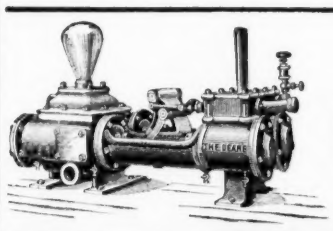
Affairs appear much brighter at the Thomson-Houston factories at Lynn, Mass., for an early resumption of work at somewhere near the accustomed activity than for some time past. Several large orders for railway motors and complete car equipments have been received, and the production of this apparatus will give employment to about the same number of hands as were employed before the partial shut-down.

A dispatch from Elmwood, Ind., says: The business situation here is growing brighter. Among the works now running are: McBert's mill, 750 hands; radiator factory, full capacity; tin plate mill, full force and behind orders; bottle works of Nevison & Weiskopf, 200 hands; McCloy's chimney glass factory, 500 hands. The plate glass factory will start up October 1, with 500 hands. The Akron Steam Forge Works are nearing completion, and the construction of the Raub Locomotive Works will begin in the next thirty days.

Mr. F. A. Scheffler, General Sales Agent for the Stirling Boiler Company, in New York, writes us as follows: We are pleased to inform you that we have recently closed the following sales: 100 horse-power for Salem, Mass., through our agent. J. B. Sargent 400 horse-power boilers for Algonquin Coal Company, and 250 horse-power boilers for Lutz, Libby & Co., Park Pl., Pa., through our agent, James Meily. We have in view several large contracts, which, notwithstanding the fact of the hard times, we feel pretty confident of closing for. We find that inquiries from various electric light and power companies, architects, etc., are coming to us to a greater extent than they did in July and August. This shows that business is unquestionably improving throughout the country.

The new station for the Lynn Gas and Electric Company, at Lynn, Mass., will be built by The Berlin Iron Bridge Company, of East Berlin, Conn. The dynamo room is 58 feet in width by 157 feet in length, the whole space being controlled by a traveling crane. The boiler room will be 48 feet in width and the same length as the dynamo room. The roof of this building will be entirely of iron, constructed under the well-known patent of the Berlin Company. The Berlin Company's patent anti-condensation corrugated iron roofing seems in great favor with electric light and power companies as it is fire proof, and at the same time they guarantee that there will be no drip or condensation on the underside of the corrugated iron. It is said that this is the only fire proof roof made where this condition can be guaranteed.

The Tradesman, Chattanooga, Tenn., in its review of the industrial situation in the South for the week ending September 11, states that while no decided change is to be noted there is an undercurrent of increased confidence, and an oft-expressed belief that the worst is over, which in itself is doing much to relieve the situation. The most gratifying feature of the week has been the resumption of work at a number of the manufacturing plants, and especially the fact that many of them are receiving sufficient orders to justify their operation. While no change has taken place in the cast iron market, the foundries and machine



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Also many new assortments for Bolts.
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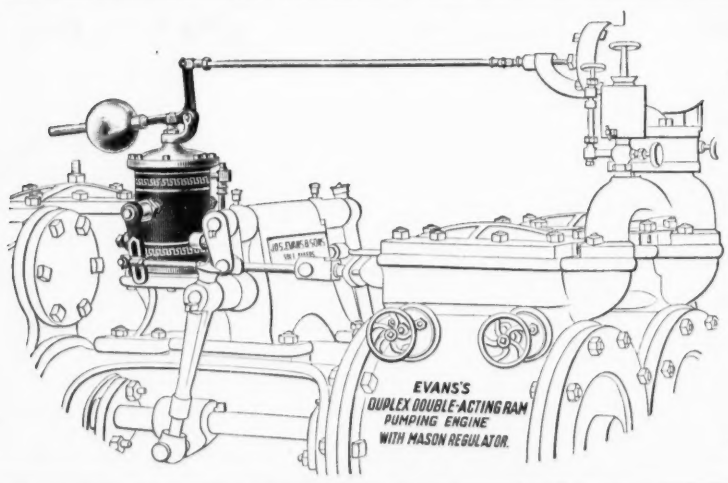

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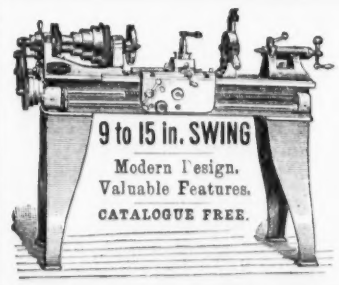

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shops generally report fair orders and with the increased accommodations they can now secure from the banks, the volume of business is being materially increased.

Machinists' Supplies and Iron.

NEW YORK, September 23, 1893.

Iron—American Pig—We quote Standard Northern brands, No. 1 Foundry, $14.50 to $15.00; No. 2, $13.50 to $14.25; Gray Forge, $12.25 to $12 50. Southern brands of good quality are obtainable at $13.75 to $14.50 for No. 1 Foundry; $12.50 to $13.50 for No. 2, and $11.75 to $12.50 for Gray Forge.

Antimony—The market is steady. We quote L. X., 9.90c. to 10.10c.; Cookson's, 10¼c. to 10½c.; Hallett's, 9¾c. to 9⅞c., and U. S. French Star, 10c.

Copper—The market is easier; Lake Copper has been sold at 9¾c. in a small way; Lake companies are asking 9⅞c. Casting Copper is held at 9⅝c to 9¾c.

Lead—The market is easy, and the demand is light. Sellers are asking 3.85c. to December, but there are indications that 3.80c would buy.

Lard Oil—Prime City is quoted at 69c. to 70c.

Spelter—The market is firmer. The asking rate is 3.85c. to 3.90c. for New York delivery during the balance of the year.

Tin The market is firm. Sales of 70 tons for October delivery at 20 90c., 20.95c , and 21c. have been made, and 50 tons for December at 21c. For spot and September 21c is quoted, and 21.10c. for October.

WANTED

"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Young man wants position as assistant draftsman. S. B. Field, Roselle, N. J.

Reliable and accurate draftsman, age 25, desires position; A1 references. Box 95, A., AMER. MACH

Exp'd. draftsman, tech. grad. desires pos. Good refs. Steam eng. work pref'd. Box 105, AM. MACH.

Mech. draftsman with exp. in cranes and hydraulic machinery wants pos. Box 100, AM. MACH.

Tool maker, years of exp. on machine shop and boiler tools, wants position; N Y or vicinity. Address P., care AMERICAN MACHINIST.

Draftsman, Norwegian age 21, tech school grad., 2 years mach. shop exp in this country, wants pos. as dftsman; good ref 28 Grant St., Newark, N. Y.

Draftsman (designer) experienced on mach. tools, jigs, fixtures and gen l mach'y desires position. Box 76, AMERICAN MACHINIST.

Stationary eng. wants pos. chief or second, 14 yrs'. exp , highest refs ; chief's license. P. L., AM. MACH.

A young, married man with 5 years' experience in machine shop desires pos. Best ref. Address Wm. Heather, care AMERICAN MACHINIST.

Mech. draftsman wishes pos : 6 years' experience in shop and drafting room. Excellent references. Address Box 101, AMERICAN MACHINIST.

I want position as traveling salesman, supplies or specialties. Large acquaintance and exp. A1 refs. Box 103, AMERICAN MACHINIST.

We want agents to handle our gas and gasoline engines in the cities of Boston and Chicago. Must be live men. Address Box 102, AM. MACHINIST.

Machine tool salesman is open for an engagement with a live, progressive firm where his sales amounting to $100,000 the past year may be doubled, and where services receive fair pay and air treatment. Fair Play Mechanicus, AM. MACH.

Wanted—Situation in Phila. as sup't, assist. sup't, chief draftsman or designer by mech. engineer of 15 years' exp.; specialties, machine tools, special machines engines (steam or gas) and el. mach'y for incand't light or el. railway; best of refs. Address Box 94, AMERICAN MACHINIST.

Wanted—Machinist and pattern maker as partners in an iron foundry in St. Louis; young men each with $500 or more; a good opening. Write J. McCash, 619 Harris Avenue, St Louis, Mo.

✣ MISCELLANEOUS WANTS ✣

Advertisements will be inserted under this head at 35 cents per line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Cheap 2d hd lathes & planers. S. M York, Clev'd, O.

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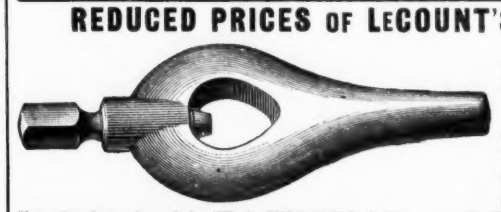

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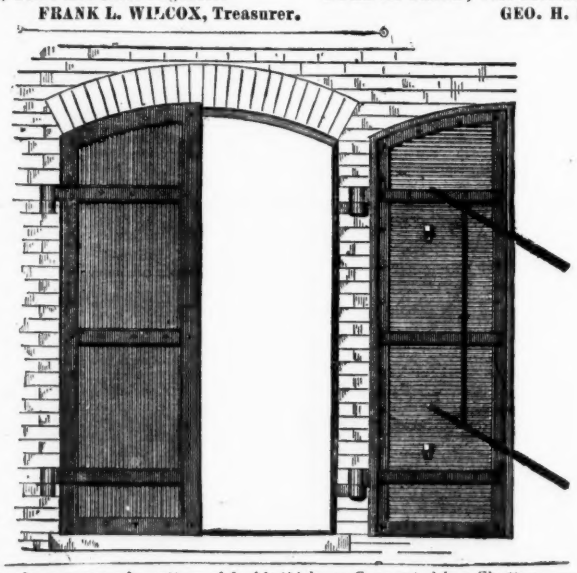

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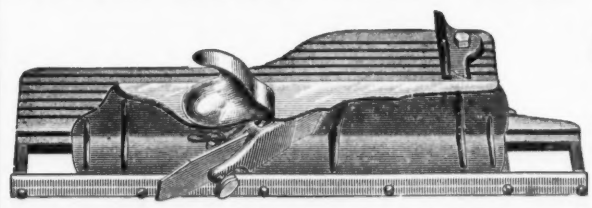

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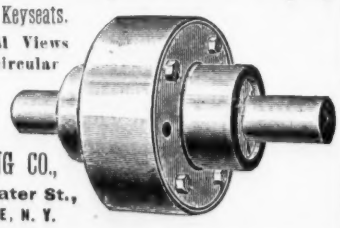

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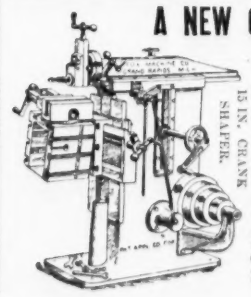

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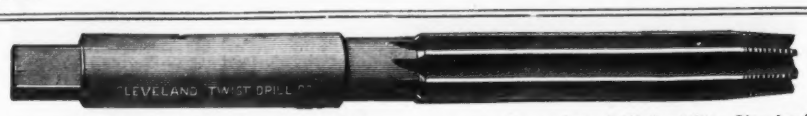

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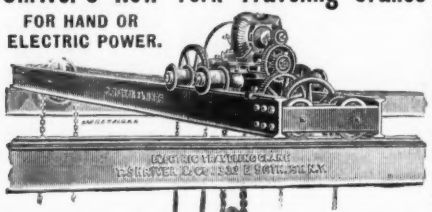

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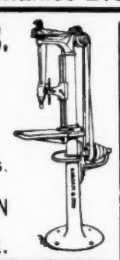

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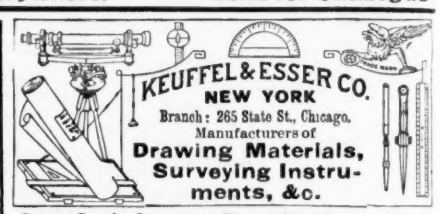

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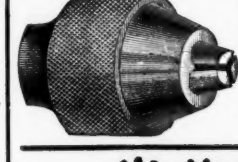

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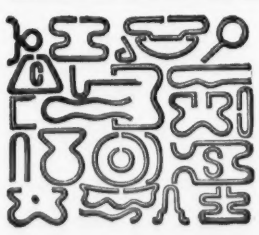

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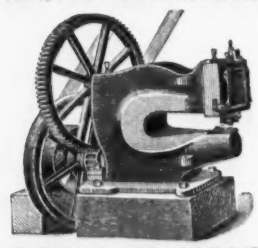

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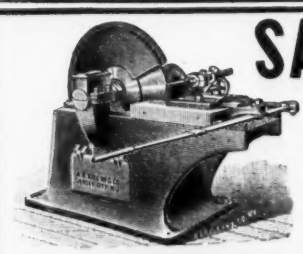

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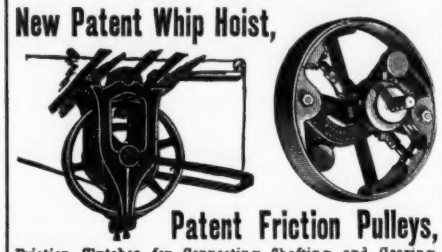

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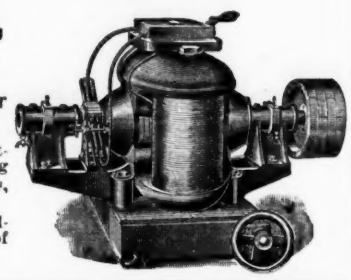

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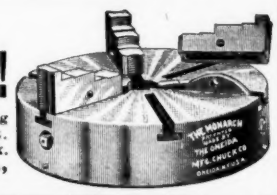

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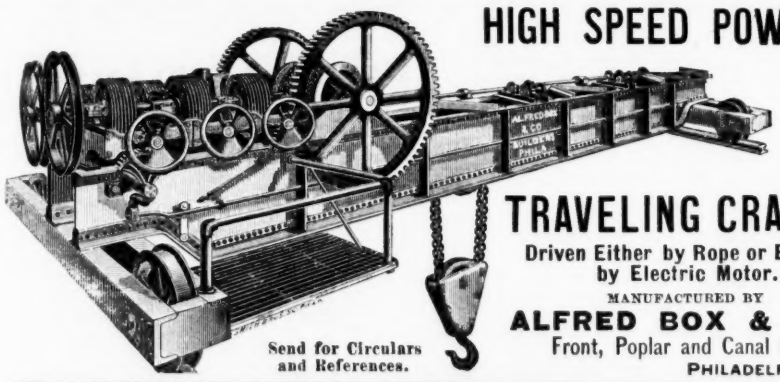

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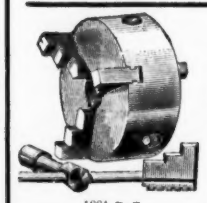

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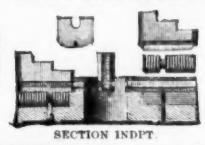

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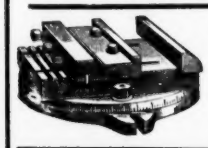

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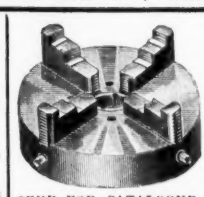

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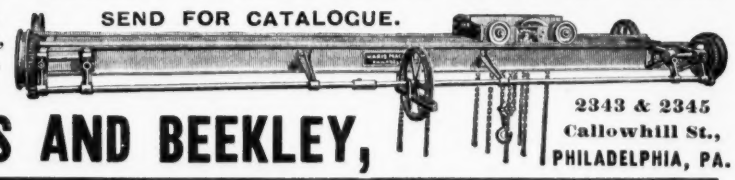

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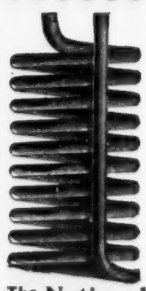

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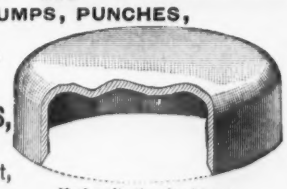

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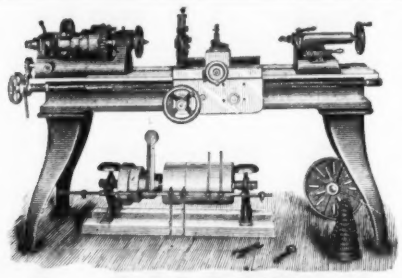

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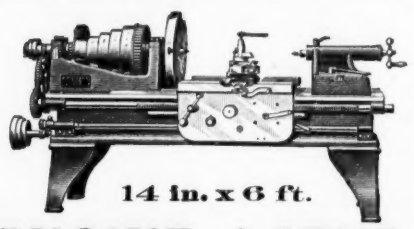

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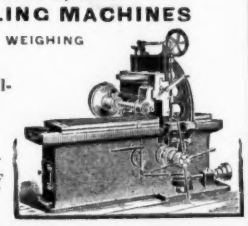

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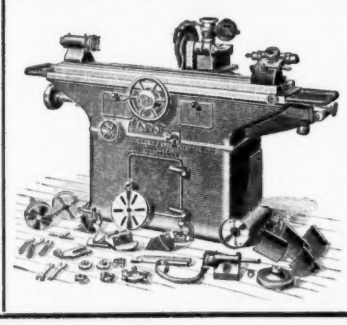

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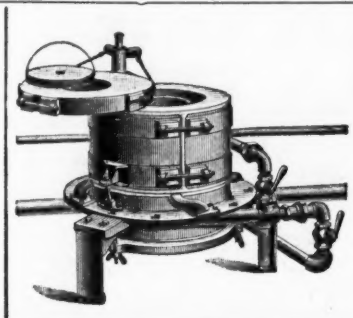

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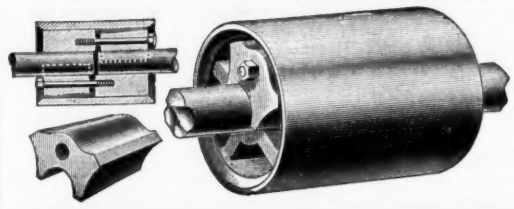

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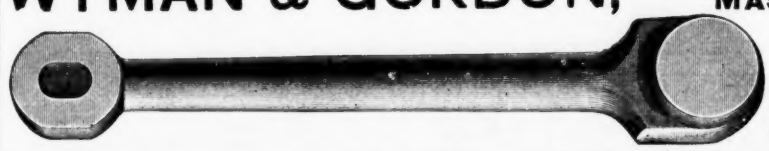

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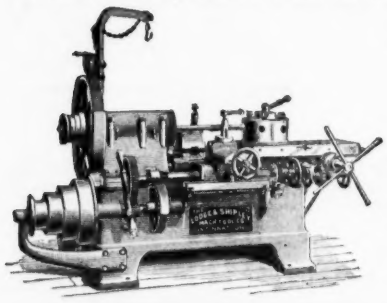

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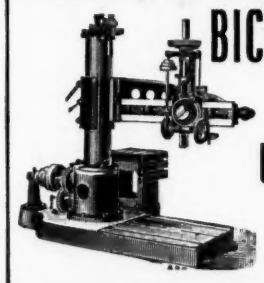

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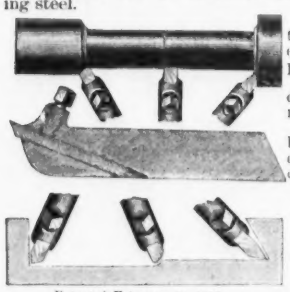

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2	1¼x1¼x 7 "	⅝ " "	2 30	35 "	22 "
3	1½x1⅝x 8 "	⅞ " "	3 00	55 "	30 "
4	1¾x1⅞x 9 "	⅞ " "	3 80	Exp'ss	40 "
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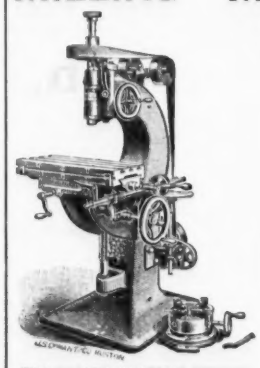

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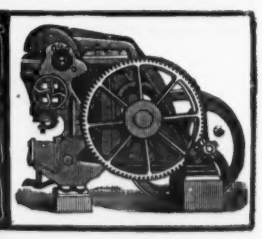

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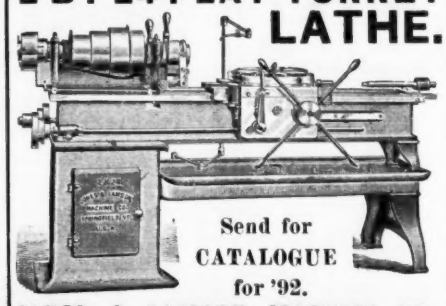

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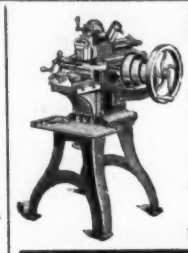

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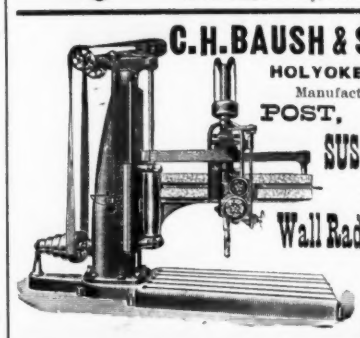

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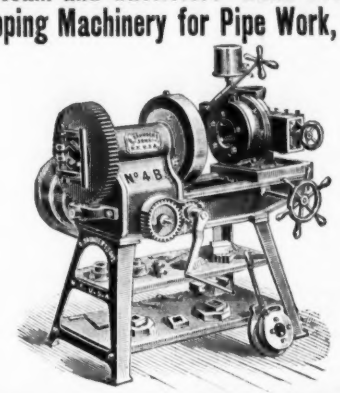

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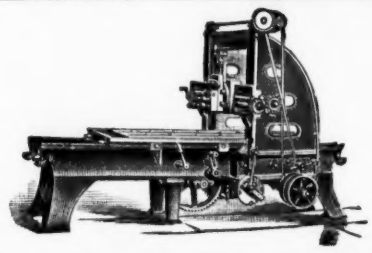

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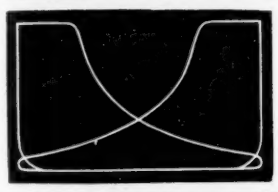

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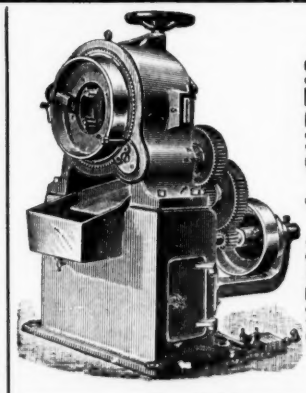

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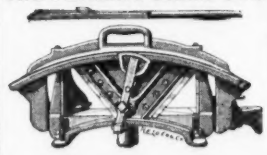

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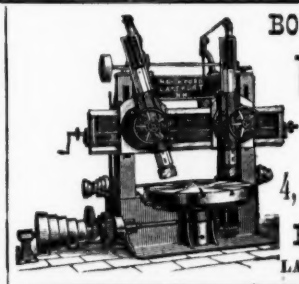

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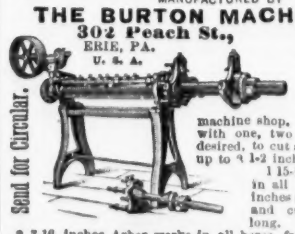

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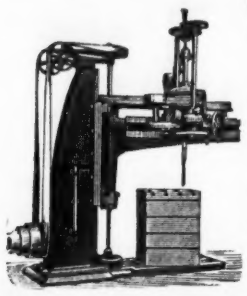

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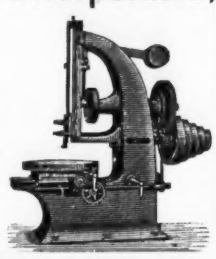

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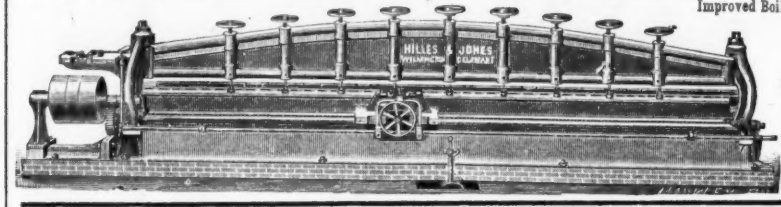

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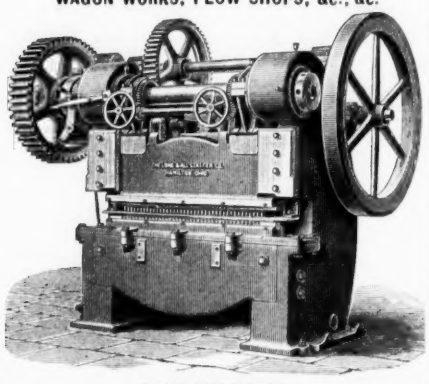

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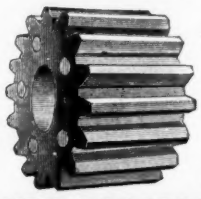

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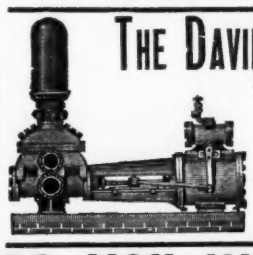

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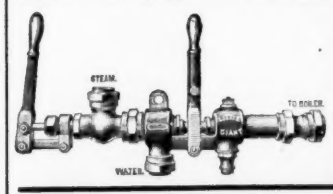

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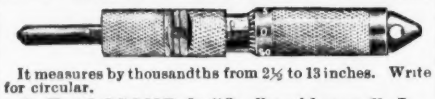

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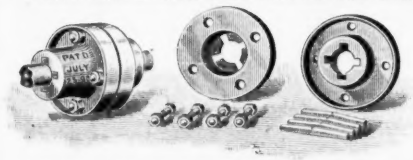

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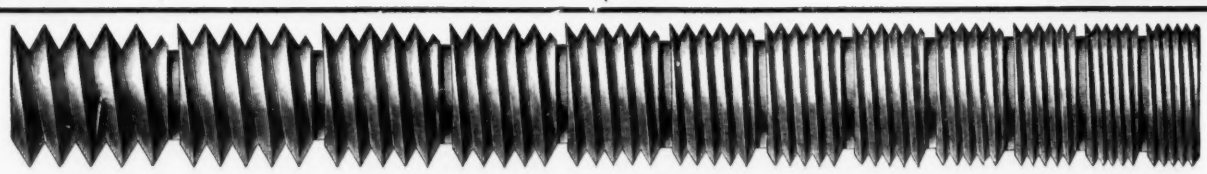

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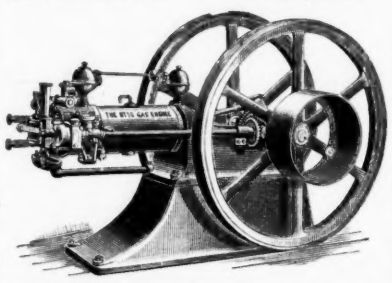

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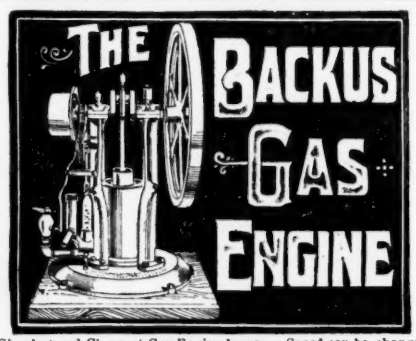

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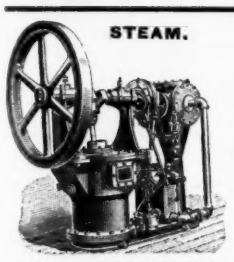

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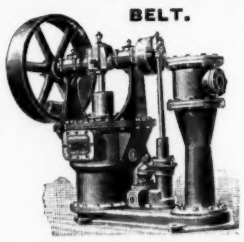

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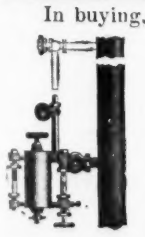

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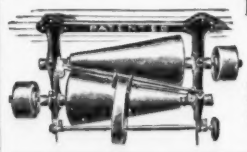

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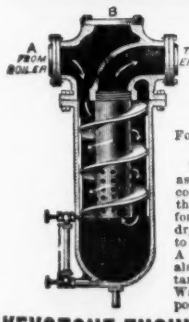

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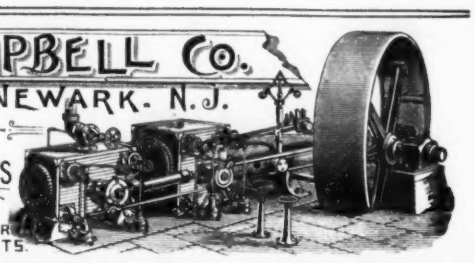

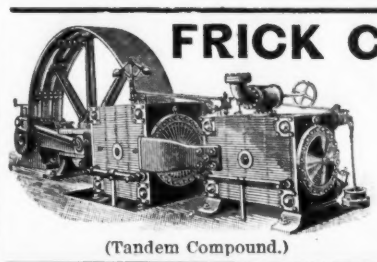

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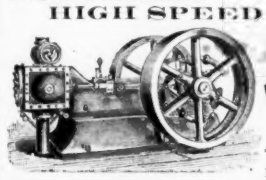

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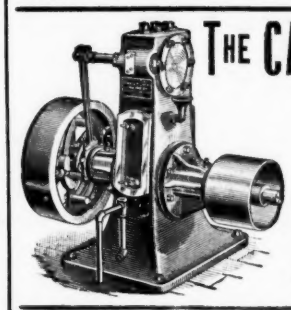

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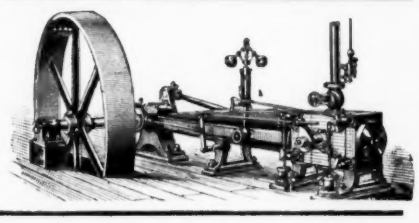

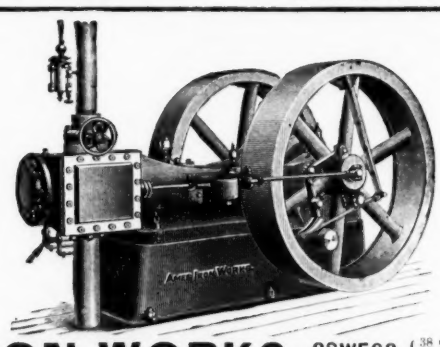

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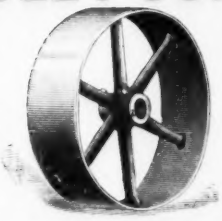

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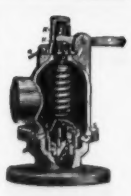

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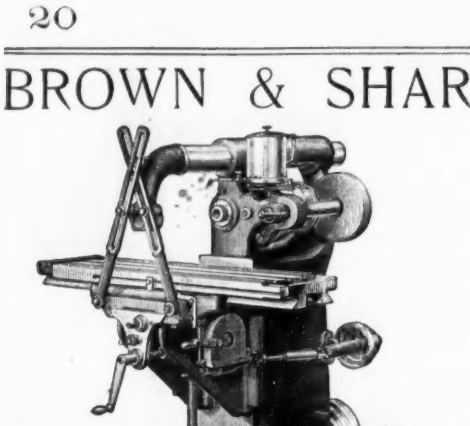

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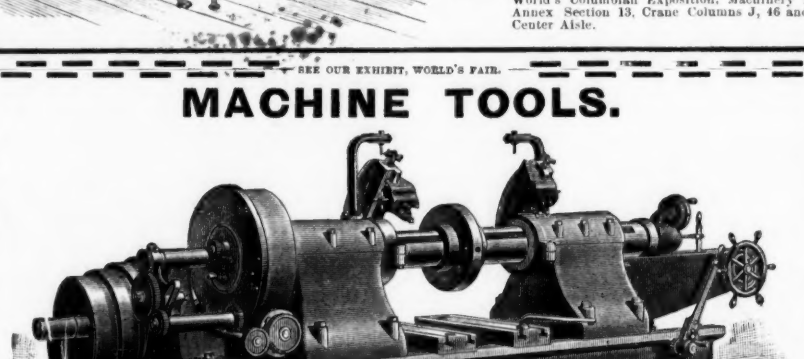

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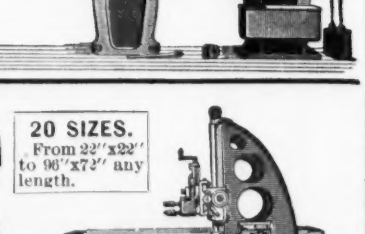

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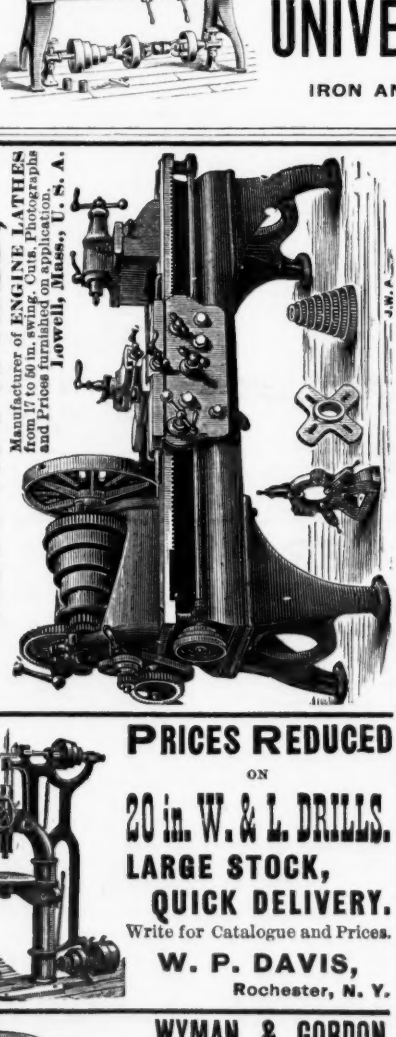

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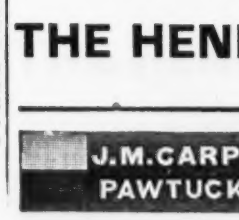

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